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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
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Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1788
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1790
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1790
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1791
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1792
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1793
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 1794

Note: N.A. means that no abstracts were assigned to this category for this issue.

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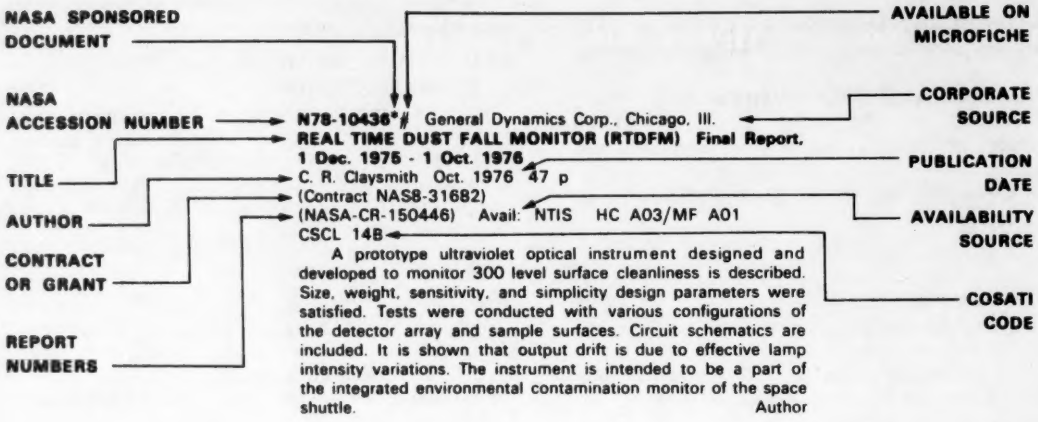
TYPICAL CITATION AND ABSTRACT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N78-10436*# General Dynamics Corp., Chicago, Ill.
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REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
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C. R. Claysmith Oct. 1976 47 p
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REPORT NUMBERS
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, HIGH ANGLE OF ATTACK AERODYNAMICS OF FIGHTER CONFIGURATIONS
J. HEADLEY, Northrop Corporation, *Hawthorne, California* 90250 (DF139900; F33615-77-C-3062)

Combat maneuver performance improvements continue to be a major design goal for fighter aircraft. The maneuver capability of this class of aircraft is usually determined by a probability of departure from controlled flight if the aircraft is inadvertently pushed to an extreme angle of attack condition. Historically, these limits have been defined in flight test with attendant risk of aircraft loss. The objective of this effort is to develop design guidelines for fighter aircraft to operate safely at high angle of attack based on existing experimental data. Rational criteria for design of air combat aircraft in the extreme angle of attack range is a requisite for improved flight safety and combat effectiveness.

Existing wind tunnel data on the F-16 and F-111 series aircraft configurations will be collected, correlated and analyzed for trends and sensitivities of flying quality parameters to geometry changes. Special attention is to be given to forebody shape and strake geometry effects which are responsible for much of the non-linear character observed at high angles of attack.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0002, NOISE AND SONIC FATIGUE OF HIGH LIFT DEVICES
H.L. LEVY, McDonnell Douglas Corporation, *Long Beach, California* 90808 (DF133910; F33615-75-C-3057)

Current Air Force interest in STOL aircraft includes designs using externally blown flaps with over-the-wing and under-the-wing blowing. Other concepts such as internally blown flaps, augmentor wing, cold thrust augmentation with hypermixing nozzles, etc., are also being investigated. Noise predictions for these concepts indicate intense noise levels will be generated and will result in potential problems associated with community noise, sonic fatigue, and internal noise. The objective of this effort is to investigate selected high lift or thrust augmentation systems as they pertain to noise generation and to define the associated noise field as it relates to performance and engine operating parameters. The results of this study will assist aircraft designers in obtaining reliable maintenance-free structure and will permit selection and design of concept with reduced noise.

Powered lift and thrust augmentation systems will be reviewed and practical systems design parameters will be determined. Consideration will be given to thrust, bypass ratio, mass flow, exit velocity, exit temperature, jet diameter, engine flap geometry, engine flap spring, etc. From the above study the most promising configuration will be selected for further investigations including both analytical and experimental phases. Model studies will be conducted investigating the practical range of design parameters to determine the acoustic loading for near field noise, and infrasound effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, AUTOMATED STRENGTH AND STIFFNESS DESIGN OF MILITARY AIRCRAFT
K.E. KADRNKA, Rockwell International Corp., *Los Angeles, California* 90009 (DF140140; F33615-76-C-3161)

This effort will advance the use in industry of automated strength and stiffness sizing in the design of aircraft lifting surfaces. Efficient automated methods of design that include static and dynamic loading requirements are needed to reduce aircraft development time and increase structural reliability and operational effectiveness. This effort will transition an automated static and dynamic design procedure for military aircraft structures (FASTOP) to practical design environments and determine the requirements for future design methods. These applications of FASTOP will allow the Air Force to expand the applicability of the FASTOP system, determine requirements for future design procedures, and demonstrate how FASTOP can be integrated into a total aircraft design process.

The contractor will select and study a military aircraft design using the FASTOP system. Problem set-up times, program discrepancies, recommendations for improvements, and a discussion of the role FASTOP could play in an overall aircraft design system will be documented by the contractor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, RESEARCH PROGRAM IN JET-SURFACE INTERACTIONS
W.C. MEECHAM, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (NSG 2290)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0005, STUDIES ON PERCEPTUAL PROBLEMS IN AERONAUTICS
K. KARAMCHETI, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 2297)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0006, INTEGRATED HINGE (ROTARY) ELECTROMECH ACTUATION DEV
N.E. WOOD, Garrett Corporation, *Torrance, California* 90509 (DF136740; F33615-76-C-3043)

The needs of survivability and safety of military aircraft cannot be allowed to depend entirely on hydraulically powered control surfaces if any reasonable alternatives can be demonstrated. The cost of providing a hydraulic power distribution system for flight control capability only in future missiles and RPV's may be too expensive. The objective of this program is to design and evaluate the use of integrated-hinge (rotary) electromechanical actuators for low-power (3 H. P. maximum) control surface actuation. A primary use of these actuators is conceived as actuating

small chord trailing edge flaps on larger control surfaces where linear actuators are at a disadvantage in finding space for installation and in providing the conversion to rotary motion in a structural efficient fashion. The program will provide needed design data concerning the feasibility of electrically powered control surface actuation for military airplanes, missiles and RPV's.

The most promising electromechanical actuator configuration defined under WU 19870153 will be selected for fabrication. Bench testing of the electromechanical actuation will parallel the type of testing that is now specified for hydraulic actuation of primary control surfaces. Typical frequency response tests will be run with the surface inertia and aerodynamic loads carefully represented. Power-in vs. power-out efficiency, thermal characteristics, and failure modes will be evaluated. Particular attention will be given to establishing a mission duty cycle because all extrapolation for electromechanical actuation use from airplanes to RPV's to missiles is intensely dependent on the duty cycle.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, EFFECT OF CONTRACTION ON TURBULENCE
M.S. UBEROI, Univ. of Colorado, School of Engin. & Appl. Sci., *Boulder, Colorado* 80302 (NSG 3181)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0008, AN INVESTIGATION OF THE FLOW DYNAMICS OF UNSTEADY SEPARATED REGIONS
M.S. FRANCIS, U.S. Air Force, Frank J. Seiler Res. Lab., *Colorado Springs, Colorado* 80840 (DF281760)

AF function - technology base. Deficiency - insufficient knowledge of the flow behavior of unsteady separated flow germane to a wing of a maneuvering aircraft. Research - develop a flow model through extensive theoretical and experimental analysis of an unsteady separated region on an airfoil. How research contributes - results will describe the behavior of unsteady separated flow germane to helicopter rotors, aircraft maneuvering at high angles of attack, and jet engine compressors. Abstract - a combined analytical and experimental investigation will be employed to determine the nature and details of the flow field physics in an unsteady separated region above a lifting airfoil. Models employing the concepts of vorticity and mass transfer will be developed to understand and explain the viscous-inviscid interactions and resultant wing loading characteristics. Wind and water tunnel experiments employing a wing with an oscillating spoiler will be used to verify the theoretical results and provide an understanding of the basic physical mechanisms. The extension of these models to various other flow situations may also be considered dependent upon the nature and characteristics of the preliminary results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

1.0009, AN INVESTIGATION OF IMPROVED AIRPLANE MANEUVERING CAPABILITIES
J.D. LANG, U.S. Air Force, Frank J. Seiler Res. Lab., *Colorado Springs, Colorado* 80840 (DF282200)

AF function - counterair. Deficiency - existing non-steady aerodynamic theory has not been fully applied to aircraft performance and maneuvering problems. Research - an investigation will be undertaken to determine the feasibility of applying existing non-steady aerodynamic theory, especially dynamic stall effects, with emphasis on expanding the maneuver envelope. How research contributes - will result in improved airplane performance and optimized maneuver tactics.

Initially, emphasis will be placed on adapting techniques to existing aircraft configurations. Consideration will then be given to identify airplane configurations which will yield further improvements in maneuvering performance. Several experiments may be designed to test ideas for configurations and/or to test the validity of analytical results. The ultimate objective is to identify those airplane configurations, and associated control techniques which will result, in fact, in achieving 'best' maneuvering capabilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

1.0010, GUIDELINES FOR NON-HUB AIRPORT
UNKNOWN, Arnold Thompson Assoc. Inc., *Riverside, Connecticut* 06878 (FA77WA-4084; FA160457 (TRAIS NO.))

The Contractor shall develop guidelines and criteria for space allocation, and facility requirements (including spatial relationships) to provide an efficient and cost-effective design for terminal building areas serving regularly scheduled air carriers certificated by the CAB at non-hub-sized communities. The guidelines shall include minimum and recommended ranges of criteria for various levels of activity within the non-hub category.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0011, CONDUCT A STUDY AND OVERALL ASSESSMENT OF EXISTING E&D PROGRAMS AND NEW INITIATIVES
UNKNOWN, Economics & Science Plan. Inc., *Washington, District of Columbia* 20036 (FA77WA-4001; FA160303 (TRAIS NO.))

The contractor shall conduct an examination of the current Engineering and Development (E&D) program and relationships between all of the elements of the E&D program. The examination is to be an independent assessment of their contributions to meeting the forecasted growth patterns of aviation over the next twenty years.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0012, AFATL F-111 LOADS PROGRAM ANALYSIS OF ACFT AND ACFT/STORE INTERFACE CARRIAGE OF STORES
W. DYESS, U.S. Air Force, Armament Laboratory, *Eglin Air Force Base, Florida* 32542 (DF643680)

Air Force function - this work unit supports the continuing F-111 store certification effort. Deficiency or opportunity - currently there is no analytical tool available within the Air Force to totally and accurately predict the loads imposed on the F-111 due to the carriage of an external store when the store aerodynamic characteristics are known. Objective - to develop a computer program for use at Eglin AFB which would be capable of correcting the above deficiency. How work contributes - the development of an analytical capability within the Air Force for determining loads imposed on the F-111 due to the carriage of a store will insure that a timely and accurate structural evaluation can be obtained when a new store is proposed for carriage on the F-111.

The capability desired will be developed as four major modules of a computer program. These modules may be run as one program or as separate parts. Module 1 will contain data which will determine the ACFT performance parameters from a data bank. Module 2 will use the attitude information from module 1 and installed store aerodynamic data to determine the aerodynamic loads on the store. Module 3 will determine the total load at the store c.g. Module 4 will transfer these loads throughout the ACFT to determine the structural integrity of the system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0013, A JET IN A CROSSFLOW
R.L. FEARN, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (NSG 2288)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0014, DEVELOPMENT OF AN AUTOMATED ADAPTIVE TRAINING SYSTEM FOR BASIC INSTRUMENT FLIGHT

R.M. JOHNSON, Appli Mation Incorporated, *Orlando, Florida* 32803 (DN494029; N61339-74-C-0141)

Develop a refined and expanded version of an automated adaptive instruction module for basic instrument flight training as presented in ground-based simulators. For purposes of preceding studies, in which the technical feasibility of implementing automated adaptive methodology was demonstrated, a training course made up of isolated tasks loosely derived from typical syllabi was adequate. Prior to implementation for testing in an operational environment, however, it is appropriate to supplement earlier findings by demonstrating a system utilizing a complete automated syllabus closely corresponding to current syllabi in use at operational training sites.

Conduct a thorough analysis of current syllabi in operational use by training squadrons; design and implement a training course to reflect impact of automated adaptive techniques and to cover the full range of tasks and skills which can be realized by synthetic training for basic instrument flight; install and demonstrate the system on the Naval Training Equipment Center's TRADEC (research simulator) facility; carry out an evaluation experiment to measure effectiveness.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Training Equipment Center

1.0015, STATIC LOADS FACILITY

G. FULLER, Martin Marietta Corporation, *Orlando, Florida* 32805 (DF641540; F08635-77-C-0104)

(1) Air Force function - this work unit is established to define aircraft and store static strength capabilities. (2) Deficiency or opportunity - currently there exists no way for the static strength capability of stores to be defined. (3) Objective - to design and install static loads test equipment and test stores. (4) How work contributes - this work will define the static strength characteristics of stores and insure store survival when exposed to varying maneuvering flight load conditions.

Design and install a static loads test facility. Based on predicted flight loads, statically test stores to determine structural integrity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0016, SUPERSONIC JET NOISE II

H. PLUMBLEE, Lockheed Georgia Company, *Marietta, Georgia* 30060 (DF460260; F33615-76-C-2021)

To develop technology to significantly reduce supersonic jet noise with minimum performance and weight penalties. The specific objective is to extend analytical models developed under AF contract F33615-73-C-2032 to more accurately account for the significant noise generation mechanisms in supersonic jets and to verify the models through aeroacoustic experimentation using advanced laser optical techniques.

To refine the jet noise theory and to verify the theory through fundamental acoustic experiments, to provide the necessary turbulence, source function and mean flow models and to verify these analytical models through fundamental aerodynamic experiments, and to develop practical prediction models based on the theoretical and experimental results of the previous phases and on related available research.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0017, EXPERIMENTAL STUDY OF TRAILING EDGE AND NEAR-WAKE FLOWS

B.R. RAMAPRIAN, Univ. of Iowa, Graduate School, *Iowa City, Iowa* 52240 (NSG 2300)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0018, HANDBOOK OF GUIDELINES FOR FLIGHT PLANNING DURING PERIODS OF HIGH OZONE OCCURRENCE

T.H. JACKSON, Control Data Corporation, *Minneapolis, Minnesota* 55420 (FA77WA-4074; FA160430 (TRAIS NO.))

A set of guidelines which can be used, in conjunction with existing or forecast synoptic conditions, by flight planners, airline pilots and other users, to minimize or avoid cruise in regions of high ozone concentrations.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0019, STOL ASSAULT TRANSPORT CREW COMPLEMENT STUDY

J.C. WOLF, Honeywell Incorporated, *Minneapolis, Minnesota* 55413 (DF139620; F33615-77-C-3065)

The work performed will support the test and evaluation functions of AF organizations involved in weapon system development. Crew station evaluation techniques will be developed and utilized in the determination of the total flightcrew complement required for the accomplishment of the tactical assault transport mission. This effort will address the crew fatigue and aircraft operation and control aspects of the crew size/composition problem, as well as investigate/develop crew workload prediction methodologies. The baseline and experience required for the development of a methodology to achieve optimal crew systems configurations which are motivated by operational concepts will result from this effort.

Mission scenarios will be generated to include total crew duties and tasks associated with the transport mission. A mission script will be developed which considers all transport crew functions. Crew station assessment efforts, sensitive to crew workload, will be pursued utilizing physiological, psychological, and mission performance data. The crew performance will be evaluated in a real time operational theater.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, TRAFFIC LOADING ANALYSIS AND MODEL

W.J. HORN, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0S8187)

The objectives of this study are to obtain aircraft traffic distribution and aircraft loading data essential to the development of the improved method of pavement design for both rigid and flexible pavements and to develop computer aids for considering traffic in pavement design.

The results of current studies associated with aircraft dynamic wheel loads, aircraft traffic distribution at civil airports, as well as earlier studies of aircraft traffic distribution at military airfields will be extended and supplemented if necessary to obtain the desired traffic distribution and loading information. Data in the form of aircraft type, load distribution, operational speeds, lateral traffic distribution, longitudinal traffic distribution and pavement temperatures will be obtained from these studies and supplied in a usable form to those elements having the responsibility of developing pavement design procedure.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

1.0021, NICKEL-ZINC BATTERY FOR AIRCRAFT AND MISSILE APPLICATIONS

R. BRWON, Eagle Picher Industries Inc., *Joplin, Missouri* 64801 (DF457360; F33615-75-C-2004)

The objectives of this effort are twofold. First, develop the necessary technology and demonstrate performance under simulated aircraft conditions of a rechargeable nickel-zinc battery as a lightweight, high discharge rate, low initial and life cycle cost source of DC electrical power which has moderate low-temperature performance capability and charge/discharge cycle life. Second, develop the necessary technology and demonstrate performance under simulated missile applications of a low-cost, automatically activated, nickel-zinc primary battery in existing hardware which has been used for similar silver-zinc batteries.

Rechargeable batteries and cells will be fabricated and tested under simulated A/C and RPV loads. Designs will be iterated using improved separators, electrodeposited and pasted nickel plates, and latex bound zinc plates. Dry charged nickel plates will be developed and tested in reserve batteries.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0022, IEMCAP F-15 VALIDATION

R. PEARLMAN, McDonnell Douglas Astro. Co., *St. Louis, Missouri* 63166 (DF736800; F30602-76-C-0193)

The objective of this effort is to provide a validation of the Intrasystem EMC Analysis Program (IEMCAP) code. This is necessary to determine prediction accuracies using the different component models as well as the over prediction resulting from frequency quantization and spectrum approximation.

The approach will be to break the F-15 aircraft up into a number of mini-systems and analyze them using the IEMCAP. These mini-systems will exercise different subroutines and models of the IEMCAP. The output of the analyses will be compared to experimental F-15 data. From this comparison conclusions on the effect of program assumptions and approximations will be formulated for future reference.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

1.0023, AIRCRAFT HYDRAULIC SYSTEM PERFORMANCE ANALYSIS

N. PIERCE, McDonnell Douglas Astro. Co., *St. Louis, Missouri* 63166 (DF456710; F33615-74-C-2016)

The purpose of this program is to provide the criteria necessary for conducting comprehensive dynamic analysis of aircraft hydraulic systems. This procedure will include constructing computer models of basic hydraulic systems components and experimentally verifying their performance.

The program objective will be reached by: 1. Selecting the hydraulic components (pumps, lines, valve seals, fluids, etc.) to be computer simulated. 2. Developing dynamic equations for these components. 3. Incorporating these equations in systems mathematical modes. 4. Generating and verifying computer programs employing the math models. 5. Training AFAPL project engineers to utilize the computer programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0024, COMPUTATIONS AND TURBULENT FLOW MODELING IN SUPPORT OF HELICOPTER ROTOR TECHNOLOGY

W.C. ROSE, Univ. of Nevada System, Graduate School, *Reno, Nevada* 89507 (NSG 2291)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0025, DEVELOPMENT OF LOW-COST CRT HEAD-UP DISPLAY SYSTEM

R. ROVER, Bendix Corporation, *Hackensack, New Jersey* 07608 (DF135980; F33615-76-C-0017)

The requirement exists in the Air Force for a low-cost easily installable head-up display system for current and future aircraft to provide flight control parameters while flying VFR. It is the objective of this effort to investigate a low-profile CRT glare shield-mounted HUD design to meet this requirement.

A contractor-designed CRT HUD will be built and installed in an AFFDL aircraft simulator for evaluation. If the evaluation is successful, a self-contained symbol generator will be built and the system will be installed in a T-39 for a flight test evaluation by the Instrument Flight Center, Randolph AFB, Texas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, PERFORM POWER SPECTRAL DENSITY GUST ANALYSIS ON 10 FEDERAL AVIATION REGULATIONS (PART 23 AIRPLANES)

UNKNOWN, Aeronautical Res. Associates, *Princeton, New Jersey* 08540 (FA77WA-3972; FA160013 (TRAIS NO.))

Using methodology contained in Air Force Flight Dynamics Lab Technical Report 75-121, calculate the normal acceleration and pitch rate frequency response functions, the structural response parameter, A, and the zero level crossing parameter, NO, in the longitudinal mode for 10 FAR (Federal Aviation Regulations) Part 23 aircraft and compare the results with other existing gust analysis methods as contained in FAA Report RD-74-160.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0027, STUDY OF THE IMPACTS OF AIRPORT USE RESTRICTIONS ON AIR FREIGHT CONSUMERS AND PASSENGERS

G. HOWARD, Port Auth. of New York & N.J., *New York, New York* 17357 (FATQWA-3875; FA59695 (TRAIS NO.))

A survey of nighttime air freight shippers and receivers shall be made to estimate the effects of local and national airport nighttime airport use restrictions on both shippers and receivers moving air freight via the Port Authority airports and their relationship. The contractor shall quantify the economic consequences to air freight consumers of both local and national airport nighttime airport use restrictions on the basis of the Waybill survey of nighttime air freight shippers and receivers. The objective is to make possible projections of national impacts of nighttime airport use restrictions.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0028, TURBINE DESIGN SYSTEM

J. KEITH, General Electric Company, *Cincinnati, Ohio* 45215 (DF458450; F33615-75-C-2073)

To develop a comprehensive aerodynamic, structural, and heat transfer evaluation capability for turbines, using computer interactive graphics techniques.

Aerodynamic, structural, and heat transfer computations are performed by modular computer programs, which communicate through an automatic data storage and retrieval system. The user communicates through an interactive display terminal and may receive both graphic and printed results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

1.0029, BASIC EROSION INVESTIGATION IN SMALL TURBOMACHINERY 13653-E

W. TABAKOFF, Univ. of Cincinnati, School of Engineering, *Cincinnati, Ohio* 45221 (DA0E9138; DAAG29 76 G0229)

To investigate the erosion process of small turbomachinery in order to develop a quantitative model which will facilitate the prediction of erosion in future advanced turbomachinery in a particulate environment. Relevance - the research is relevant to the development of erosion-resistant components for helicopter gas turbine engines and, to a lesser degree, to the design of efficient filtration devices for Army gas turbine-driven generator sets.

Factors affecting ductile erosion, such as angle of impingement, particle velocity, size, shape, and strength, will be investigated experimentally. Experimental and analytical work will be performed to examine the effects of target material size, velocity dependence due to the angle of impingement and the aerodynamic effect of temperature on erosion of alloys for future compressors and turbines.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0030, SUBSONIC WING AERODYNAMICS STUDY

G.M. GREGOREK, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (NSG 2296)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0031, FLIGHT CONTROL ACTUATION SYSTEMS DEVELOPMENT
G.D. JENNEY, Dynamic Controls Incorporated, *Dayton, Ohio* (DF134910; F33615-75-C-3068)

Few military aircraft currently utilize active controls due to the recent advent of this type of application. Improved aircraft performance and other advantages may be realized; however, new requirements are placed upon the actuation systems. A prime objective of this program is to improve the effectiveness of actuating systems for active controls, ultimately extending the useage of this technology.

A survey and study of existing active control actuator systems will precede a test and development effort. Prime areas for system improvement will be determined and subsequent development efforts will be accordingly concentrated. Eventual expanded military aircraft active control application and associated performance and other improvements will follow as a product of improved active control actuator system technology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0032, CHECKOUT AND DEMONSTRATION OF ENGINEERING FLIGHT SIMULATION MODELS FOR HYBRID COMPUTATION
J.J. BANKOVSKIS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF132880)

The engineering flight simulator is a modern tool for the analysis and evaluation of current and future Air Force systems. Development of proposed flight control system schemes including cockpit controls and displays requires man-in-the-loop participation throughout the design evolution. Providing accurate, realistic mathematical models of flight simulation-related tasks for increasing the adequacy and flexibility of a modern flight simulation facility is the objective of this work effort. Tasks to be considered for implementation are simulation and evaluation of weapon delivery modes, navigational aids for terminal area operation, target images generated with a computer-generated image system and develop realistic turbulence and wind shear models. The development of these and other flight simulation-related tasks into a library of functional special-purpose programs is necessary for improved flexibility and operational requirements in a facility which will actively participate in the design, development and evaluation of Air Force piloted systems.

The approach to be followed will be to assist the contractor in an active manner with the particular requirements of the Engineering Flight Simulation Facility computation equipment. This in-house support will continue through the checkout and demonstration of the contractor effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0033, METALLIC BOX BEAM DESIGN CONCEPTS EVALUATION
G.T. ESTILL, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131230)

Application of new and improved structural airframe concepts is restricted for lack of demonstrated and validated cost savings, weight savings, and structural integrity. A cooperative effort with LTV(VSD) will investigate advanced low-cost structural concepts in terms of weight savings, cost savings, and structrual performance using box beam components designed and tested to the same aircraft design requirements. A weight savings of 22 percent and a cost savings of 25 percent compared to conventional baseline box beam should be validated.

An A-7D outer wing box beam component will be used to evaluate and compare three advanced metallic design concepts with a conventional baseline concept. Two fatigue and one fracture article will be fabricated and tested for each design concept. Structural tests will be conducted to compare fatigue and damage tolerance performance of each concept. Other comparisons including weight and cost savings will be made to demonstrate the benefits of the application of advanced metallic structures technology to include composite-reinforced metal lamination, adhesive bonding and low-cost fabrication techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0034, DYNAMICS OF SUPERSONIC DIFFUSERS FOR LASER SYSTEMS
D.K. MILLER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136520)

This work unit supports development efforts in the area of high-energy laser weapons systems suitable for airborne applications. At present, high-energy gas dynamic and chemical lasers are difficient in that they lack efficient, compact, easily started supersonic diffusers which would allow them to be exhausted to ambient pressure conditions. It is the objective of this work unit to develop and demonstrate supersonic diffuser concepts for both gas dynamic and chemical laser applications. All concepts developed must have the following characteristics: (a) at least normal shock pressure recovery, (b) quick start capability, (c) operational simplicity, (d) size and weight compatible with airborne applications. The development of supersonic diffuser concepts with the above characteristics will greatly inhance the feasibility of the high-energy laser as an airborne weapon system.

The approach of this effort is to validate experimentally diffuser concepts which have a high probability of satisfying the pressure recovery requirements and size constraints of operational high-energy gas dynamic and chemical lasers. Although the research effort is primarily experimental, analytical techniques are used extensively in the design of concept validation experiments, and in the assessment of the data collected from these experiments. The principal diffuser concepts under investigation are the slanted cascade diffuser concept for gas dynamic laser applications, and the radial outflow diffuser concept for chemical laser applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0035, RESEARCH IN STABILITY AND PERFORMANCE OF MISSILES
F.M. SAWYER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140600)

The aerodynamic forces and moments acting on a missile performing a general pitching, yawing, and rolling motion are not fully understood. It is the objective of this research to increase the understanding of the aerodynamics of missile motion and to provide aerodynamic data which will aid in optimizing the design and performance of missile systems.

The approach is to conduct and sponsor theoretical, analytical, and experimental research on aerodynamics stability problems associated with air-launched and entry missiles. Emphasis will be directed toward the development and utilization of dynamic wind tunnel testing techniques, analysis of flight data, and theoretical prediction of aerodynamic stability coefficients.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0036, ANALYTICAL TECHNIQUE DEVELOPMENT FOR PRELIMINARY DESIGN OF ADVANCED USAF AIRCRAFT
B.L. WHITE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138460)

Preliminary aircraft design concepts must be investigated as completely as necessary to insure a high degree of confidence in such areas as structural integrity, reliability, and maintainability and yet assure a low-cost and minimum-weight structure. The confidence in design concepts and cost estimation cannot be developed without the use of sophisticated design concepts and design-to-cost estimating techniques. Therefore, the purpose of this program is to enhance the capability of the preliminary design group in the area of design analysis techniques by acquiring and/or modifying computer programs and developing an exper-

tise with these programs to be used in the design of military aircraft.

Computer programs including, but not limited to SQ-5, APAS, VDEP, FASTLODS, BUCLASP, and SWEEP will be studied, tested, and evaluated to gain the required analytical techniques for ongoing and future preliminary design of advanced USAF aircraft. Also, cost models being developed will be collected and used to determine the cost impact of advanced technologies on aircraft structures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0037, AUTO/MANUAL TAKEOFF/LANDING
W.L. YOUNG, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134800)

At present, a capability of performing routine landings and takeoffs during category III meteorological conditions does not exist for either the Air Force or commercial airlines. The objective is to develop concepts, techniques and equipment requirements for low-visibility operations in both the manual and automatic mode.

The approach is to use a suitably modified and instrumented C-141 aircraft to verify by flight test the requirements necessary for CAT III operations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0038, AN ANALYSIS OF THE LOGAIR DISTRIBUTION SYSTEM USING OPTIMIZATION PRINCIPLES
J.L. KENNINGTON, Southern Methodist University, Graduate School, *Dallas, Texas* 75222 (DF046150; AF-AFOSR-3151-77)

AF function - LOGAIR is an air freight network used by USAF to support its major installations. Deficiency - the two civilian carriers make no routing or scheduling determinations. This is done by personnel at AFLC, using methods based on experience and certain estimations. The result is an arrangement that is almost surely far from best. Objective - to bring some mathematical theory of scheduling and integer programming to bear on the problem to increase the amount of freight transported or to decrease the cost of the transportation operation. How work contributes - the work would be the only theoretical effort that addresses this particular problem. Any improvement, even if not the optimum solution, would result in cost savings of millions of dollars to the Air Force.

A combination of improved interfacing among routes, better scheduling, and alternative aircraft assignments matched to flow requirements would significantly alleviate the present deficiencies in costly, abnormally long 'pipeline' times. The methods to be used are part of the science of mathematical programming.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0039, LIGHTNING STUDY FLIGHT TESTS
UNKNOWN, U.S. Natl. Aero. & Space Adm., Langley Research Center, *Hampton, Virginia* 23665 (FA77WAI-756; FA160228 (TRAIS NO.))

Obtain data on the effects of electromagnetic transients associated with lightning near an aircraft in flight. Further identify electromagnetic noise sources associated with flights near thunderstorms and characterize the sources. Obtain in-flight measurements of airframe excitation in response to electromagnetic sources. Measure electrical currents induced on selected wires inside the aircraft as a result of the airframe excitation. Assess the adequacy of the installed instrumentation system for measurements of the nature identified above.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0040, EVALUATION OF BLADE TIP PLANFORM EFFECTS ON HOVER PERFORMANCE - ARMY HELICOPTER
B. MASKEW, Analytical Methods Inc., *Bellevue, Washington* 98004 (DA0D4081; DAAJ02-76-C-0069)

To develop a mathematical analysis, based on lifting surface theory, for the prediction of helicopter rotor performance in hover and in a vertical climb.

Portions of existing analyses will be modified and combined to provide an analysis capable of modeling rotor blades with arbitrary radial variations in planform, twist, and airfoil section. The analysis will be based on the vortex lattice method and will include a free wake analysis, a boundary layer analysis, and representations of blade thickness, flow viscosity, and flow compressibility effects. This analysis will be used to predict c sub p - c sub t curves and blade loading distributions to be correlated with existing test data and to be compared with the corresponding predictions from a lifting line analysis and a blade element momentum analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0041, EXTENSION OF FLEXSTAB FOR ANALYSIS ACCURACY AND EFFICIENCY
J. DORNFELD, Boeing Company, *Seattle, Washington* 98108 (DF138870; F33615-76-C-3170)

Control configured vehicle (CCV) flight control systems (FCS) are being designed to improve the operating efficiency of military aircraft and therefore reduce their operating costs. The benefits of the CCV FCS are to improve the fatigue life, ride qualities, handling qualities and maneuverability of military aircraft and thus improve mission performance. The objective of this work is to advance level 2.01.00 FLEXSTAB capabilities to design and analyze advanced CCV FCS, and also to provide support to AFFDL, other Air Force offices and private industry. Primary FLEXSTAB R&D efforts under this program are to determine the limit of applicability and perform preliminary analysis to include the following: finite-element structural theory, improved Kusner Wagner and/or doublet lattice unsteady aerodynamics, load equations for the design and analysis of load improvement control systems, experimentally distributed loads, efforts of control surface elasticity. The finalized results shall be documented recommending necessary development and additional in-house and contractual efforts for FY 76 and FY 77.

This work will consist of analytical and experimental studies to determine the best methods to modify FLEXSTAB to produce more accurate and cost-effective prediction methods. The approach is to: (1) formulate dynamic load equations based on level 2.01.00 perturbation output, (2) incorporate these equations into the controls-free analysis programs, (3) determine limits of applicability, (4) recommend other in-house and contracted efforts, (5) provide additional support. Reports will be prepared during the course of this effort to document significant accomplishments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0042, PRIMARILY ADHESIVELY BONDED STRUCTURE REPAIR
R. HORTON, Boeing Company, *Seattle, Washington* 98108 (DF138370; F33615-76-C-3137)

New and innovative type structures will be developed under the primary adhesively bonded structure (PABST) advanced development program. When incorporated in aircraft systems, economical means of maintenance and repair must be available. This effort will develop needed criteria and techniques to perform cost-effective repair for the new structural concepts.

Cost-effective repair criteria and techniques applicable to adhesively bonded structure on military aircraft will be developed. Consideration will be given to the capabilities of AFLC depots as required to implement the results of this effort. A number of specific repairs will be made on which structural tests will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, PAYLOADS FOR SPACE
J.W. MAR, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 7396)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, LASER-INDUCED CHEMISTRY OF PROPELLANTS
R.A. SHATAS, U.S. Army, Physical Sciences Directorate, *Huntsville, Alabama* 35809 (DA0F1346)

Demonstrate and investigate the production of decaborane-14 by laser-induced photochemistry. Demonstrate and investigate laser-initiated fast curing of propellants.

A laser-induced photochemistry facility will be designed and assembled to include a multigas tunable high-power pulsed IR laser and a Fourier transform spectrometer for time-resolved measurement of reaction intermediates. Initially, multiline laser experiments will be performed in an attempt to validate pulsed laser enhancement of hydroborane and carborane formation. Experiments on laser curing of propellants will also be performed. Associated theoretical calculations will be performed.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Physical Sciences Directorate

3.0002, NEW PERFLUOROPOLYMER-FORMING REACTIONS
M.S. TOY, Science Applications Inc., *La Jolla, California* 92037 (DF042390; F44620-76-C-0027)

AF function - future Air Force flight operations require better environment resistant materials. Deficiency - a need exists for low TG elastomers with better high-temperature stability than existing materials. Objective - the objective of this research is to study the nature of O-F bond dissociation and additions to unsaturated perfluorocarbon bonds and to demonstrate polymer forming reactions that can be utilized to synthesize perfluoropolymers with elastomeric properties over a broad temperature range. How work contributes - the work will determine the usefulness of the newly synthesized materials in high-temperature applications.

The research will study the dissociation of the covalent O-F bond by homolytic and heterolytic cleavages and the nature of addition of the O-F bond to unsaturated perfluorocarbon bonds from perfluoroolefins, perfluorodienes, perfluoroaromatics, and perfluoroheterocyclics under free radical, anionic, and cationic environments. The study will include new perfluoropolymer-forming reactions identified in the research involving reactions of primary and tertiary mono- and di-fluoroxyperfluoroalkanes and primary and tertiary perfluorodialkyl peroxides with mono- and di-perfluoroolefins, perfluoroaromatics, and perfluoroheterocyclics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, INTERACTION STUDIES OF SIMPLE AND REACTIVE GASES WITH TRANSITION METAL FILMS SUPPORTED ON INSULATING SUBSTRATES
G.M. POUND, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NCA 2-745807)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0004, OPTICAL AND MECHANICAL PROPERTIES OF GLASSES FOR DOMES
P.B. MACEDO, Catholic University of America, School of Engin. & Arch., *Washington, District of Columbia* 20017 (DN575000; N00014-76-C-0201)

Components fabricated of glasses are of use in demanding applications including IR domes, radomes, and fiber optic waveguides. Their chief asset is transparency in the infrared, visible and microwave regions. However, they fracture at low levels of mechanical or thermal loading, and show complex and appreciable absorptions. This work concentrates on tailoring of compressive stress profiles to strengthen silicate glasses.

Dopants (Cs20,PbO,B203) are being investigated as to composition effects on strength and resistivity. New base glass compositions will be explored as to high strength levels. Residual surface compression to high temperatures, thermal fatigue behavior and abraided strength are being studied for these materials. Effects of multiple dopants will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0005, HYDROCARBON LOW-TEMPERATURE VISCOSITY
C.T. MOYNIHAN, Catholic University of America, School of Engin. & Arch., *Washington, District of Columbia* 20017 (DN590222; N00019-77-C-0065)

One problem with some new candidate air-breathing missile fuels of the high-energy-density hydrocarbon type is the high-viscosity characteristics in the low-temperature end of specification requirements. This program will study the relationship between molecular structure of such hydrocarbons and their freezing point and viscosity behavior.

Phase diagrams will be obtained for isomer components of the type derived from norbornadiene. Thermodynamic and viscosity data will be obtained and correlated for the dimers.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0006, FRACTURE MECHANICS RESEARCH
D.L. JONES, George Washington Univ., School of Engin. & Appl. Sci., *Washington, District of Columbia* 20037 (DN590094; N00019-76-C-0151)

Program to obtain an improved understanding of the effects of cyclic loading on the fracture toughness and strength of aircraft structural materials.

Study the relationship between the cyclic load-displacement record and the number of load cycles for several materials, including 7050 Al and Ti6Al-4V GFC will be examined at higher cyclic parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0007, SURVEILLANCE - PRESSURE SENSITIVE PLASTICS
M.G. BROADHURST, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (DN223239)

The Navy is a large user of piezoelectric (pressure-sensitive) devices for detecting acoustic signals. Certain plastics have been found to exhibit piezoelectric activity and have the advantage that they can be formed into thin films and other shapes which are impractical for ceramic piezoelectrics. It is the purpose of this research to understand the piezoelectric phenomenon in plastic materials and to find means for enhancing it to make practicable their use in instruments for detecting pressure changes.

A suitable theoretical model for piezoelectricity in polymers will be developed and experimentally tested. A relationship will be sought between molecular structure and motions and the piezoelectric phenomenon. An attempt will be made to optimize the piezoelectric effect. An investigation of the relationship of

pyroelectricity (thermal effects) to piezoelectricity (mechanical effects) is part of this research.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0008, BASIC CHEMICAL AND PHYSICAL PROPERTY EVALUATION, HAZARD ANALYSIS AND HANDLING OF SYNTHETIC JP-5 FUEL

R.N. HAZLETT, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN580087)

To determine the basic chemical, physical and flammability properties of jet fuels derived from oil shale, tar sands, and coal. To define composition/property relationships of alternate fuels and to examine ways to modify unsatisfactory properties by compositional change. To determine the effectiveness of standard fire-fighting techniques with synthetic fuel and to develop additional methods and procedures as needed.

NRL is performing a comprehensive chemical, physical and flammability program to evaluate the characteristics of jet fuels derived from shale oil, tar sands and coal. The NRL work will emphasize non-specification tests, composition/property relationships, and chemical analyses. Fire suppression techniques for substitute JP-5 will be evaluated in tests up to volumes of 300 gallons of fuel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0009, NAVY VEHICLE & MATERIAL SUPPORT TECHNOLOGY - MECHANISMS OF CRACKING IN HIGH-STRENGTH ALLOYS

D.A. MEYN, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN220026)

Cracking mechanisms, resultant from presence of trace elements, of alloys which are either in-service or are candidates for in-service aircraft weapons systems are studied via electron fractography in order to better understand these mechanisms and alleviate the problems.

Crack initiation and fracture processes are dependent upon the stress, trace elements, and microstructures local to the crack tip. Titanium, steel, and aluminum alloys are studied in both laboratory specimens and in service-failed components in order to both carefully control crack tip conditions and to compare these laboratory studies to those from the specialized laboratory of service conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0010, ELECTROTRANSPORT IN THIN FILMS

R.E. HUMMEL, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (DF042830; AF-AFOSR-2963-76)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Deficiency - the occurrence of metal migration effects at elevated temperatures for various contact metal systems causes failure of these solid-state devices and thus reduces the reliability of systems employing these devices. Objective -the objective of this research is to obtain an understanding of the mechanisms which are operating in the electrotransport of one-component and dilute alloy thin metal films. How work contributes - an understanding of the electrotransport mechanism and the factors which promote or retard this process will allow for further improvement in metalizations for microwave solid-state devices. In particular, the role played by metallic underlays in the electrotransport of various thin metallic films appears to be significant.

Various techniques will be used to measure the activation energies for electrotransport in thin films (on the order of 3000 Angstroms) of copper, magnesium, tin, palladium and platinum. The role of the grain boundary network in electrotransport will be investigated by preparing a variety of aluminum and gold thin films. Annealed and unannealed samples will be compared. In addition, an attempt will be made to measure the Hall effect in thin films of gold in order to identify the primary charge carrier in the electrotransport process. Electrotransport in two-metal systems will also be investigated. Thin layers of gold will be deposited on a variety of transition-metal underlayers (such as chromium, molybdenum, tantalum). Annealed samples will be examined both before and after electrotransport by means of Auger analysis and ion milling in order to determine the interpenetration of the two components. Homogeneous, two-component thin-film alloys of aluminum will be prepared, either by co-deposition or two-layer deposition and diffusion anneal, and examined for their electrotransport properties. The advanced resistometric technique will be used to measure the activation energies. This technique will be supplemented by scanning and transmission electron microscopy, optical microscopy and radioactive tracer studies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, THE EFFECT OF MICROSTRUCTURAL FEATURES ON THE RESPONSE OF ALUMINUM ALLOYS TO CYCLIC DEFORMATION

E.A. STARKE, Georgia Inst. of Technology, School of Chemical Engineering, *Atlanta, Georgia* 30332 (DF037750; AF-AFOSR-2615-74)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. Opportunity - in fact, the fatigue properties of structural materials often limit their application. Thus, it is important to understand the mechanism of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Objective - this research will determine the effects of microstructural features on cyclic deformation modes. In particular, it will clarify certain ambiguities concerning cyclic softening behavior of age-hardened aluminum alloys, and distinguish those features which cause the low fatigue stress/tensile strength ratio inherent in these materials. How work contributes - since aluminum alloys form a major portion of the material currently used for skin and other structural airframe applications, it is appropriate that they are the basis of this investigation.

The broad fundamental understanding of the fatigue behavior of aluminum alloys to be developed during the course of this research will provide the basis for carrying out future alloy and process development to achieve improved materials. In addition, the principles developed during the course of this investigation should also be applicable to other age-hardening systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0012, INITIATION MECHANISMS OF SOLID ROCKET PROPELLANT DETONATION

H. NAPADENSKY, I I T Research Institute, *Chicago, Illinois* 60616 (DF040790; F44620-75-C-0059)

AF function - this effort directly responds to requirements specified in research objective 5.1. Future missile systems will employ nitramine propellants. Deficiency - current attempts to develop Navy systems using these propellants have experienced unscheduled detonations. Objective -this contract seeks to identify the causes and mechanisms of deflagration to detonation transition. How work contributes - permits the use of high-energy propellants for optimized propulsion performance without creating unreliable systems.

Theoretical and experimental studies of impact phenomena will be conducted in pursuit of the objective which will permit the determination of significant energy dissipation, and hence, sites of possible initiation in the propellant.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, NAVY ENVIRONMENT - MECHANISMS OF HYDROGEN EMBRITTLEMENT IN METALS AND ALLOYS USED IN NAVAL STRUCTURES

H.K. BIRNBAUM, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DN123376; N00014-75-C-1012)

This research undertakes to clarify the mechanisms by which hydrogen can embrittle metals and alloys, such as those used for naval aircraft and ship structures.

Crack initiation and propagation mechanisms in metal--hydrogen alloys are being investigated over a range of hydrogen contents, temperatures and stress conditions. Standard metallurgical techniques are being used.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0014, NON-STEADY COMBUSTION MODELING

J.R. OSBORN, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (DA0H4532; DAAD05-72-C-0342)

Precise thrust termination of solid rocket motors requires that the combustion processes of the burning propellant be capable of being extinguished upon command. This leads to the requirement that the response of a burning solid propellant to rapid pressure decay be well characterized.

An experimental and analytical program will be conducted for determining the deflagration limits of selected composite rocket propellants. The experimental approach will involve burning the propellant sample in a specially constructed vessel equipped for reproducing the thrust termination environment-that is, steady-state burning at an elevated pressure followed by an extremely rapid pressure decay to atmospheric pressure. The analytical approach will involve extending the existing theoretical work of Ryan. Comparisons of the analytical and experimental work will be made for determining those physical and chemical propellant parameters affecting the deflagration limit of composite solid propellants.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

3.0015, IGNITION OF FUEL SPRAYS BY HOT SURFACES AND STABILIZATION OF AIRCRAFT FIRES

J.G. SKIFSTAD, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (DF050030; AF-AFOSR-3446-77)

AF function - weapon delivery and defense, transport, aircraft fire safety, vulnerability and survivability in accident and combat situations. Deficiency - insufficient understanding of basic physical, chemical and fluid dynamic processes of ignition, propagation, stability, and quenching of both internal and external aircraft fires and explosions caused by engine and fuel system damage. Objective - to obtain experimental data for the ignition of fuel sprays by hot surfaces as affected by the properties of the fuel spray, the airflow, and the surface, to investigate experimentally the stabilization of external fires by large-scale flameholders, regions of separated flow on flat surfaces, and jets, to investigate the gasdynamics of combustion in partially ventilated enclosures, and to extend and develop theories for these phenomena. How work will contribute - will provide experimental data and theoretical models not presently available for the ignition by hot surfaces of several combustible substances, including kerosene and alternative fuels, will extend the understanding and range of characterization of possible flameholding objects such as may occur in structural damage to the airframe, will provide a better understanding of the flow and flame stability in void-space fires, each of which will improve hazard assessment for both accidental fires and fires caused by combat damage, and in general, contribute to reducing aircraft vulnerability and survivability.

Ignition of fuel sprays will be investigated by injection of a fuel spray into an airflow of known properties in a pipe, the fuel spray/air mixture subsequently passing through a heated pipe section wherein ignition occurs. The influence on the ignition process of the properties of the spray (smd, fraction vaporized), the air flow (p,t,v turbulence characteristics) and the surface (t, length, surface characteristics) will be investigated for each fuel considered. Correlations based on the experimental data will be developed, leading to appropriate theoretical models. Stabilization of fires by large-scale flameholders and related flows will be investigated in a combustion tunnel. Initial investigations will be conducted with v-type and l-type gutters using the LeFebvre water injection method, by means of which the complete stability loop will be obtained. Propane and kerosene fuels will be employed. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0016, COMBUSTION KINETICS OF SELECTED AROMATIC HYDROCARBONS

R.A. MATULA, Louisiana State Univ. Systems, School of Engineering, *Baton Rouge, Louisiana* 70803 (DF049360; AF-AFOSR-3384-77)

AF function - all aircraft functions. Deficiency - advanced air-breathing engine technology involving replacement fuels of the future requires much fundamental data on the chemical behavior of such fuels in combustors and exhausts. Objective - this research will study experimentally and analytically the mechanisms and rate constants of high-temperature thermal decomposition and oxidation of prototypical hydrocarbon components of alternate fuels. How work contributes - the results of this work will be used to optimize the performance and minimize smoke formation in jet combustors.

Quenched reaction products from a single-pulse shock tube will be analyzed by gas chromatography, mass spectrometry and chemiluminescence. In conventional chemical shock tube experiments, post-shock concentrations will be followed by optical spectroscopy, pressures by transducers, and soot production by adsorption of laser light. Data from both experiments will be combined in an analytical program to obtain mechanisms and rate constants for both quasi-global and elementary pyrolysis and oxidation reactions. Initial priority will be given to toluene, cyclohexane and decalin.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, SURFACE CHEMISTRY AND THE SEARCH FOR LIFE ON MARS

R.L. HUGUENIN, Univ. of Massachusetts, Graduate School, *Amherst, Massachusetts* 01002 (NSG 7397)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0018, RELATIONSHIP OF ABLATIVE MECHANISMS TO FIBER PERFORMANCE AGAINST LASERS

E.M. HEALY, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0G4271)

The objective of this effort is to determine the mechanisms of ablation and other breakdown pathways, when fibrous polymers and other materials of potential value in individual protection are exposed to infrared CW laser radiation.

Selected polymeric materials will be exposed to controlled laser irradiation to 10.6 microns and other wavelengths of interest. Delineation of breakdown processes will be sought by examination of volatiles, condensible materials and residues, with and without positive removal of ablated material.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0019, MACRO/MICRO STUDIES OF HYDROGEN EMBRITTLEMENT MECHANISMS IN TITANIUM AND ALUMINUM ALLOYS

W.W. GERBERICH, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (DF046300; AF-AFOSR-3133-77)

AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials including steels, titanium, aluminum and nickel-base alloys. The various forms of hydrogen-related mechanical property degradation severely restrict the serviceability of important aircraft materials. Opportunity - basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack. Objective - this research will investigate the hydrogen embrittlement susceptibility of titanium and aluminum alloys from both macroscopic and

microscopic points of view. Macroscopic studies will focus on a fracture mechanics evaluation of the effects of gaseous and internal hydrogen on threshold stress intensities and crack growth conditions; microscopic studies will focus on the mechanistic details of nucleation and growth processes in concentration gradients. How work contributes - this not only has ramifications to alloy design, but carries specific ramifications to component design where sustained load, spectrum fatigue loading or corrosion fatigue might be encountered.

Factors to be investigated include: specimen thickness, internal versus external hydrogen, temperature effects, phase stability, hydride formation, decohesion at particle-matrix interfaces, and in situ concentration profiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, NAVY ENVIRONMENT - FRETTING FATIGUE DAMAGE OF STRUCTURAL MATERIALS

D.W. HOEPPNER, Univ. of Missouri, School of Engineering, *Columbia, Missouri* 65201 (DN123528; N00014-75-C-0670)

The objective of this research is to determine the causes and failure mechanisms associated with fretting corrosion and fretting fatigue damage of structural alloys.

The investigator is undertaking a study of the manner in which fretting damage influences fatigue life on the fretted materials. The materials to be studied are steels, titanium and aluminum alloys. Variables to be assessed are: fatigue load, normal load, surface finish and surface material. Surface damage is to be ascertained by scanning electron microscopy and conventional metallurgical techniques. The establishment of the physical processes that lead to the initiation of fretting-fatigue damage is sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0021, ENERGY AND MOMENTUM EXCHANGE BETWEEN SOLIDS AND GASES

L.B. THOMAS, Univ. of Missouri, Graduate School, *Columbia, Missouri* 65202 (DF042550; AF-AFOSR-2934-76)

Air Force function - aerospace vehicles. Deficiency - lack of knowledge of interactions of gas molecules with solid surfaces. Objective - to complete additional measurements of clean-surface tangential momentum accommodation coefficients on magnetically suspended, spinning balls, and to analyze and prepare for publication a large body of data compiled from the previous work of the principal investigator on momentum and energy accommodation on surfaces of known cleanliness or known coverage with gas molecules. How contributes - by making generally known the physical details of these interactions and the conditions governing them, it should be possible to make more accurate a-priori predictions of aerodynamic forces as well as to be better able to 'design around' gas contamination processes on spacecraft carrying optical and infrared or ultraviolet sensors or emitting devices.

A large body of raw data accumulated from previous measurements of thermal accommodation coefficients by the principal investigator will be corrected and prepared for publication using recently accomplished measurements of mercury pumping effect and temperature distribution on tungsten filaments. Some additional data points will be taken to complete certain sets of data. Tangential accommodation coefficients will be measured by the magnetically suspended spinning disc method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, FACTORS AFFECTING ELECTROSTATIC HAZARDS

D. RHYNARD, Mobil Oil Corp., *Paulsboro, New Jersey* 08066 (DF461620; F33615-77-C-2047)

Determine effects of currently approved fuel additives on fuels doped with anti-static additives. Determine effects of additive-fuel combinations on fuel electrostatic properties.

Contract to Mobil Res. and Dev. Corp. to conduct experimental tests over a wide range of temperatures to measure effects of fuel additives on fuel charging and electrical conductivity properties.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory SFF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0023, THEORETICAL AND COMPUTATIONAL STUDIES OF ELECTRONIC TRANSITIONS IN MOLECULAR COLLISIONS

T.F. GEORGE, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (DF039660; F44620-74-C-0073)

AF function - laser development to enhance airborne applications. Deficiency - there is presently available no visible laser based on electronic transitions that are populated by chemical reactions. Objective - develop better theoretical techniques and more efficient computational algorithms for describing reaction dynamics and energy transfer in gas-phase molecular collision systems. Particular emphasis will be given to processes involving electronic transitions and hence dynamical interaction among multiple potential energy surfaces. How work contributes - provides increased understanding of reaction dynamics and energy transfer in molecular rate processes at the microscopic level to help delineate the favorable chemical conditions for obtaining lasing at short wavelengths.

Electronic transition processes include atom-diatom collisions consisting of halogen and hydrogen atoms. New directions include the study of gas-phase molecular rate processes in the presence of an intense, laser radiation field and unimolecular photodissociation reactions of triatomic species. The technical approach will be executed within both the semi-classical and quantum mechanical formulations. Ground and excited-state potential energy surfaces will be constructed with semiempirical techniques such as the diatomics-in-molecules method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0024, NAVY VEHICLE DESIGN AND CONSTRUCTION - FATIGUE FRACTURE OF COMPOSITE MATERIALS

N.S. STOLOFF, Rensselaer Polytechnic Inst., School of Engineering, *Troy, New York* 12181 (DN123038; N00014-75-C-0503)

Directionally solidified composite materials can have exceptionally high creep and yield strengths. Such materials can be used in turbine blading to permit higher operating temperatures and efficiencies in jet engines. The investigators will examine effects of microstructure on mechanical properties and fatigue resistance in several directionally solidified alloys.

The fatigue properties of directionally solidified eutectics will be examined to determine the effects of microstructural refinement and heat treatment. Fatigue crack nucleation and fatigue crack growth will be followed for a variety of directional microstructures. The strain-lifetime relationship of nickel base-TaC eutectics in low cycle fatigue will be found for the temperature range from room temperature to 1000 degrees C.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0025, NEW CONCEPTS FOR THE ENHANCEMENT OF HIGH-STRENGTH ALUMINUM ALLOY PROPERTIES

F.H. COCKS, Duke University, School of Engineering, *Durham, North Carolina* 27706 (DF038230; AF-AFOSR-2632-74)

AF function - fundamental knowledge of the effect of mechanical, chemical, electrochemical, and metallurgical influences on load-bearing capability of structural materials is required to assure the availability and effective utilization of superior materials in future aerospace systems. Opportunity - for example, knowledge of the metallurgical basis of stress corrosion processes and to rational alloy development. Furthermore, this improved understanding of the metallurgy of high-strength aluminum aircraft alloys can be expected to lead to improvements in other properties such as toughness and resistance to fatigue

damage. Objective - this investigation will establish the quantitative relationships between mechanical properties, stress corrosion characteristics, and the detailed physical metallurgy of precipitates, dislocation structures, matrix properties, and grain boundaries. How work contributes - specifically, the influence of alloying additions such as Ca, Sr, and Ba which are only sparingly soluble in aluminum will be examined.

A basic concept of the investigation is that these elements which may be present in only minor amounts in the matrix, may account for a major portion of the precipitate phase and thereby greatly affect properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0026, EFFECTS OF HOT FORGING VARIABLES UPON MICROSTRUCTURE AND PROPERTIES OF METALS AND ALLOYS

A.R. ROSENFIELD, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF043000; AF-AFOSR-2971-76)

AF function - Air Force applications of metals and alloys generally require some metal-working operation to bring parts to final shape before assembly. Forging of materials is a very common means of producing sound parts having uniform composition, microstructure, and properties for use as engine discs, blades, and vanes, and also in non-engine components such as structural airframe parts. Opportunity - a knowledge of forging variables has far-reaching consequences, including considerable production cost savings and optimum mechanical properties in the final part. Objective - this research will develop a fundamental understanding of the behavior of metals which are subjected to complex strain/strain rate/time/temperature histories, and how this behavior affects the hot forging response of the material. How work contributes -the understanding of forging fundamentals can best be accomplished through an approach incorporating a cooperative interaction between materials scientists actively engaged in the field of high-temperature deformation and fracture, and mechanics skilled and experienced in analyzing metal flow during complex processing operations.

This research will involve determining quantitative relations between hot forging process variables such as working loads, strain rates, and temperature, and the material response in terms of flow, fracture, microstructure and mechanical properties. The research will be performed on pure aluminum and nickel, and alloys of aluminum and nickel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0027, STUDY OF SURFACE-STRENGTHENING MECHANISMS IN REACTION-SINTERED SILICON NITRIDE

M.G. MENDIRATTA, Systems Research Labs. Inc., *Dayton, Ohio* 45432 (DF049810; F49620-77-C-0124)

AF function - ceramic turbine engines for remotely piloted vehicles (RPV) are being developed for greater cost savings and higher performance. Opportunity - the reaction-sintered method of forming silicon nitride (RSSN) offers an attractive opportunity for cost savings in manufacturing turbine components. Objective - the objective of this research is to understand and develop surface-strengthening mechanisms for RSSN. How work contributes - since brittle ceramic fracture frequently originates at surface flaws, especially RSSN, surface treatments are expected to significantly increase the useful design strengths of these materials.

The major emphasis will be placed on the systematic correlation of mechanisms of oxidation and mechanisms of strength improvement/degradation. Full characterization of the surface scale and its effect on the fracture-mechanics will be evaluated. Dense silicon nitride coatings on RSSN will also be evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0028, ELASTOHYDRODYNAMIC LUBRICATION STUDIES

J.N. CRISP, Univ. of Dayton, School of Engineering, *Dayton, Ohio* 45409 (DF047460; AF-AFOSR-3229-77)

AF function - propulsion systems and other mechanical devices for advanced aerospace vehicles require improved lubricants which will withstand a wider range of temperature conditions, greater contact loads and higher shear rates. Deficiency - lubricant materials continue to fail at elevated temperatures and under high loads due to complex change in their physical, chemical and elastohydrodynamic (EHD) properties. Objective - understand the effects of elastically deformed contact surface on boundary lubrication performance. How work contributes -information gained from this research will be used to formulate improved lubricants for further AF application.

The proposed research is intended to prepare the necessary computer programs to determine the pressure distribution from measured film thickness for the isothermal EHD point conjunction and to extend the research to include the temperature distribution within the EHD point contact conjunction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0029, MATERIAL SUPPORT TECHNOLOGY - CRYSTAL MISMATCH IN ELECTROLUMINESCENT MATERIALS

C. LAIRD, Univ. of Pennsylvania, School of Engin. & Appl. Sci., *Philadelphia, Pennsylvania* 19104 (DN475115; N00014-76-C-0360)

To undertake a study of crystal defects, such as dislocations, which arise at the interface boundary during heteroepitaxy and to suggest possible modifications of the growth for fabrication of reliable devices that find use in Navy electronics systems.

Epitaxial films of GaAsP, InGaP and InAlP will be grown on substrates of GaAs, GaP, and InP, respectively, both in step and graded heterojunction geometries. Observation slices will be prepared for study by electron microscopy of the quality and crystalline characteristics of the films. Of particular interest in dislocations due to stress arising from cooling of the substrate-epitaxial layer interface and studies of the formation and behavior of the dislocations to be carried out with the aim of controlling their density.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0030, MECHANICS OF PRIMARY MICROSTRUCTURAL FEATURES OF TITANIUM

J.L. SWEDLOW, Carnegie Mellon University, Inst. of Technology, *Pittsburgh, Pennsylvania* 15213 (DF043480; AF-AFOSR-2993-76)

AF function - structural material reliability increases are necessary in order to reduce AF cost of ownership. Increased knowledge of crack initiation is a major essential need in prediction of total structural life. Deficiency - crack initiation life of both air frame structures and engine structures is not reliably predicted with existing theories of material and fracture behavior. Objective - the objective of this research is to apply finite-element analysis to titanium alloy microstructure in order to investigate strain localization, void formulation and crack initiation. How work contributes - this research contributes to Air Force technology requirements to increase the capability of accurately predicting structural material failure.

Physical metallurgists have long been concerned with relationships between microstructure and macro-behavior of structural alloys. Two models will be investigated for this information - first, the microstructure itself, its configuration and mechanical properties, and second, the sequence of events observed to occur when the alloy is subject to loading. Finite-element analysis techniques will be used to analyze observed experimental behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0031, HIGH-TEMPERATURE OXIDATION AND CORROSION OF IN-SITU COMPOSITE ALLOYS

J. STRINGER, Univ. of Liverpool, *Liverpool, England, United Kingdom* (DF681000; AF-AFOSR-2785-75)

AF function - advanced propulsion systems. Deficiency - the behavior of directionally solidified eutectic alloys in high-temperature oxidizing environments is not well defined. Research - determination of the oxidation behavior and the interface reactions between phases in various oxidizing environments as a function temperature, phase distribution and volume fraction strengthening phase. How research contributes - to meet the demands of strength stability at the higher operating temperatures of advanced turbine engines directionally solidified eutectics (in-situ composite) alloys are being developed. However, both the compositions and the microstructures of these alloys suggest poorer oxidation resistance than presently used superalloys. Therefore, a quantitative evaluation of their oxidation behavior as a function of composition and microstructure is a prerequisite of a long-range development program.

Several oxidation tests will be conducted on in-situ composite alloy compositions of technological significance. These tests are (a) oxidation, (b) oxidation following presulfidation, (c) oxidation of salt-coated specimen, and (d) oxidation in Dean apparatus with salt being continuously supplied. Complementary studies will be conducted of the reactions at solid/solid and solid/solid/environment interfaces for the pertinent phases.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Materials Lab.

3.0032, MATERIALS SUPPORT TECHNOLOGY - CHARACTERIZATION OF ORGANIC MATERIALS

C.H. WANG, Utah Higher Education System, School of Science, *Salt Lake City, Utah* 84112 (DN323116; N00014-75-C-0908)

Organic materials, such as polymeric coatings and lubricants, are in wide Navy use, and in order to predict their reliability under a variety of conditions, it is essential to understand their characteristics, and especially their breakdown mechanisms. It is proposed in this research to study the changes of physical properties of organic materials in the vicinity of transition points, such as glass transition temperatures, and to correlate changes in these materials with their molecular properties.

Low-frequency intra- and intermolecular motions of molecules in solids, liquids, and liquid crystals will be studied, using an electric field-induced Raman scattering, Brillouin scattering and other techniques. These studies will be carried out under varying conditions of temperature to observe changes near transition points.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0033, ADVANCED MATERIALS FOR SOLUTION OF SPECIAL PROBLEMS (IMPROVEMENT OF MECHANICAL PROPERTIES OF GRAPHITE FIBERS)

S. GOLDFEIN, U.S. Army, Mobility Eqp. Res. & Dev. Com., *Fort Belvoir, Virginia* 22060 (DA0M3721)

Develop a method for improving the tensile compressive and impact strengths of graphite fiber composites for use in bridges, boats, helicopter blades, etc. It is especially applicable to bridges for the 80's program.

An attempt will be to convert the micro ribbons of which the graphite fiber is made into a composite in order to minimize the damage which they sustain by virtue of their movements while under stress. The approach to be used will be the same as the one used to correct for the dry area in the fiberglass, i.e., inject a suitable matrix into the mass converting it from a group of loose members. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Army, Mobility Equipment Research & Development Command

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, DISTANCE MEASURING EQUIPMENT (DME)

W.B. WARD, U.S. Army, Advanced Sys. Concepts Office, *Huntsville, Alabama* 35809 (DA0F1111)

A. Perform a DME demonstration using existing DME from the Air Force (ALSS) and the Hawk missile in a surface-to-surface role before the end of FY 77. Six (6) missile flights are planned. B. Captive flight test an improved DME capable of meeting a specified ECM threat before the end of FY 77 using WSMR drone formation control system (DFCS) as a base. C. Air Force to test the ALSS DME against an ECM threat to provide data on a pulsed DME system to compare with data obtained on a CW DME system by the Army.

Modify the DFCS at WSMR for improved capability to resist jamming. The captive tests will be power scaled such that the present power output can be used while still giving a realistic test for future power increases. Processing gain will be improved by application of the present DFCS adaptive threshold and addition of CFAR (constant false alarm rate). The captive flight tests will be conducted with the airborne unit on a helicopter.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Advanced System Development & Manufacturing Tech. Dir.

4.0002, ELECTROMAGNETIC PULSE (EMP) PROPAGATION IN AN ELECTRON CONDUCTION PLASMA

R.N. CARLILE, Univ. of Arizona, School of Engineering, *Tucson, Arizona* 85721 (DF042680; AF-AFOSR-2949-76)

AF function - transmission of communication signals following a nuclear weapon detonation is of vital importance. Deficiency - some theoretical work exists regarding the transmission of electromagnetic pulse (EMP) generated by nuclear weapons. No experimental verification of this theory is available today. Objective - this effort will use existing experimental setups and will build new advanced ones to perform experiments which will prove or disprove the aforementioned theory. These experiments will use non-dimensional similarity considerations between the d-region absorption of the ionosphere and plasma wave guide. Two types of plasma generation will be considered - (a) one by electron beam, and (b) another by a plasma (arc) discharge. A special type of pulse generator will produce the EMP. All the necessary instrumentation will be provided to measure electron temperature, density, pressure and other important magnitudes. How it contributes - this research was strongly recommended by AFWL to test their theoretical calculations.

This investigation uses non-dimensional analysis for simulation and examines the absorption of an EMP by the d-region layers. The absorption takes the form of joule heating that heats the electrons and which in turn by collisions dissipate thin energy to the neutrals. The investigation is essentially experimental in approach.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0003, BASIC RESEARCH IN ELECTRONICS (JSEP)

D.J. ANGELAKOS, Univ. of California, School of Engineering, *Berkeley, California* 94720 (DF008700; F44620-76-C-0100)

AF function - electronic research is essential to all Air Force missions and functions, especially aerospace reconnaissance, communications, surveillance, navigation, command and control of operating forces, and gathering, processing, and transmission of intelligence and information. Technology for all of these functions requires more compact, lower power consumption, higher sensitivity and more reliable electronic components, networks and systems. Opportunity - this technology is dependent on continued research on properties of electronic materials, circuits, and systems. Objective - the Joint Services Electronics Program (JSEP) provides the research baseline in the electronic sciences for all three military services. How work contributes - jointly and equally supported and managed by the Air Force, Army and Navy, this program provides the DoD with a hard-core electronic research capability which includes a highly flexible, quick response to new research opportunities over a broad area of electronic science and engineering.

Four areas of electronic research are being conducted - solid-state electronics, quantum electronics, electro-magnetics, and information systems. Research in these areas entails fundamental theoretical and experimental studies of gaseous lasers, optical propagation systems and solid-state lasers, of semiconductor devices, semiconductor properties and technologies, studies in select areas of scattering and measurement techniques, and of computers, signal processing, circuits and systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, STUDIES IN TRANSONIC FLOWS USING NUMERICAL METHODS

M. HOLT, Univ. of California, School of Engineering, *Berkeley, California* 94720 (DF044890; F49620-76-C-0006)

AF function - advanced aerospace vehicles. Opportunity -improvement of present semi-numerical methods for solving viscous flow problems. Objective - develop numerical techniques for treating both inviscid and viscous aspects of transonic flow. How work contributes -improvement in the capability to make viscous flow calculations will improve the design of advanced aerospace vehicles.

The calculation of high subsonic flow past a double wedge by Telenin's method will be extended to the lifting case. Then the use of Telenin's method to calculate supercritical flow past ellipses and airfoils will be extended to include shock waves and lifting effects. When these inviscid techniques are working satisfactorily they will be combined with the method of integral relations to calculate airfoil flows with viscous interactions. Finally, all this work will be extended to apply to cascades of airfoils modeling compressor blades. Simultaneously the finite element will be developed for the same flow configurations as an alternative technique.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0005, OPTICAL TRANSMISSION THROUGH TURBULENT ATMOSPHERE

H. GAMO, Univ. of California, Graduate School, *Irvine, California* 92664 (DF033270; AF-AFOSR-3097-76)

AF function - advances in Air Force surveillance, reconnaissance and optical communications systems require improved methods and devices. The ability to predict and adapt to laser propagation under all weather conditions is also required. Deficiency - there is much information on laser transmission and absorption properties of the atmosphere, but turbulence has not been modeled such that it can be used in existing codes. The long-term goal of this work is to develop a model for laser propagation through turbulent air. Objective - the propagation of laser beams through turbulent atmosphere will be studied both experimentally and theoretically with emphasis on the statistical modeling of the turbulent atmosphere for optical transmission, and the investigation of new optical and electronic techniques for the imaging of incoherent light sources through the fluctuating medium. Contributions - the planned research involves novel and innovative ideas for imaging incoherent objects through fluctuating media and for developing a model for turbulence. These are important scientific and practical problems.

The amplitude and phase fluctuation of laser beams transmitted through both artificially generated turbulence and the real atmosphere will be analyzed under various conditions of the wind velocity, average temperature, temperature structure function of the atmosphere and humidity. A few important laser frequencies, 632.8 nanometers (He-Ne gas laser) and 1.06 micrometers (Nd - YAg laser) and its second harmonic, will be used for these experiments. The simulation experiment will be performed by using the artificially generated turbulence in a special wind tunnel developed during earlier research. In order to analyze phase fluctuations due to the turbulent atmosphere, an optical interferometer using optical heterodyne detection will be used. The coherent background beam will be transmitted through a graded-index single optical fiber. Spatial cross-correlation of laser intensity or amplitudes transmitted through the turbulent atmosphere will be performed using an integrated array of photovoltaic detectors interfaced to the data acquisition computer. These quantities will be utilized for the imaging of incoherent sources.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, FIBER OPTIC COST ANALYSIS PROGRAM (FOCAP)

R.H. REID, Rockwell International Corp., *Los Angeles, California* 90009 (DF105850; F33615-76-C-1260)

Current a/c data transfer systems are heavy, susceptible to EMP, lightning, EMI, exhibit low reliability and are very expensive. It is believed that the implementation of fiber optic technology can improve airborne internal data transfer performance while reducing existing deficiencies. The objective of this program is to analyze the economic proposition of replacing current hardwire data transfer systems with fiber optic data transfer systems on a selected aircraft. Both far-term and near-term fiber optic applications will be addressed.

Current costs of hardwire data transfer systems will be defined for the selected aircraft. Costs associated with EMI and EMP protection, electrical isolation, connectors, special cables, volume occupation, weight, data handling requirements, installation, operation and maintenance, and special requirements, will be defined for current wire type systems and compared with a data transfer scheme supported by fiber optic technology. Fiber optic cost considerations will be based on near-term (involving dedicated point-to-point and multiplexed point-to-point data links) and far-term (fiber optic data bus utilizing passive optical couplers) applications. Cost savings or additional expenses as a result of using fiber optic data transfer systems will be derived as a function of time, therefore, indicating the degree of development impetus required for minimum cost to the government. Qualitative cost figures will be made available for the determination of incorporating fiber optic technology into selected AF data transfer systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0007, WAVES AND INSTABILITIES IN STEADY-STATE HIGH-BETA PLASMAS

N.C. LUHMANN, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (DF035050; F49620-76-C-0012)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of high-beta processes occurring in plasmas such as waves and instabilities caused by beams of particles and photons. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by a well-planned theoretical and experimental research. Objective - this project will investigate both theoretically and experimentally the behavior of high-beta plasma specifically studying their waves and instabilities, their interaction with electron and laser beams as well as the abnormally high appearing resistivities. Contributions - this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This project will perform theoretical and experimental work to understand waves and instabilities appearing in high-beta plasmas. Specifically, it will study the occurrence of a MHD instability near the ion gyrofrequency in a current free arcjet plasma. It will investigate the interaction of electromagnetic radiation with high-density plasma such as dense plasma focus and beam pellet plasmas. Special cases of the instabilities to be studied are associated with (a) stimulated Brillouin scattering, (b) stimulated Raman scattering, and (c) stimulated Compton scattering. To perform the aforementioned experiments and study the various parametric instabilities work on finite band width driven pumps will be continued, and the effects of plasma heating in various geometrics will be studied. In addition, anomalous resistivity will be investigated. Such understanding may elucidate the mechanism of auroral areas which are said to occur at the inter-

face of magnetospheric and ionospheric plasmas. These are decided highibeta plasmas ranging from beta 0.1 to 1.0.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, PLANAR REACTIVE DEPOSITION OF INP FILMS

L. FRAAS, Hughes Aircraft Company, *Malibu, California* 90265 (DF044640; F44620-76-C-0133)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Opportunity - future systems will require devices which are capable of operating at higher frequencies with lower noise figures, and at greater efficiencies. Theroetical predictions and initial performance results indicate that microwave devices made from InP will significantly outperform similar devices fabricated from the two microwave materials, Si and GaAs, in use today. Objective - the objective of this work is to undertake materials research on the preparation of InP substrates and the epitaxial growth and characterization of thin films of InP. How work contributes - this work will thus contribute to the improvement of microwave solid-state device performance by overcoming the material preparation problems associated with InP.

This research involves the growth and characterization of InP epitaxial layers on InP substrates. Purchased substrates of InP with various crystallographic orientations and with several dopants (Cr and Se) will be used. Epitaxial growth of InP will then be accomplished by the planar reactive deposition (PRD) process. In the PRD process, indium is placed in a Knudsen cell in a high vacuum system. Phosphine and hydrogen are then introduced into the cell where decomposition results in P2 and H2. The In and P co-evaporate onto the substrate and form the InP. This technique offers precise thickness control (approx. 1 micron/hour) over large areas at low temperatures (less tham 400 degrees C). The parameters of substrate temperature, substrate orientation and epitaxial growth rate will be optimized for the PRD process. After the growth parameters have been optimized, dopants such as selenium and tin will be introduced in order to achieve n-type doping in the epitaxial layers. In order to evaluate the effect of changing the various growth and doping conditions for InP, the resulting epitaxial layers will be examined for their structural, electrical, and optical properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, TURBULENCE MEASUREMENTS IN A COOLED-WALL SUPERSONIC BOUNDARY LAYER 12505-E

A. DEMETRIADES, Philco Ford Corporation, *Newport Beach, California* 92663 (DA0F5575; DAAG29 75 C 0014)

A controlled experiment will be performed to generate a supersonic turbulent boundary layer over a cooled surface. Mean flow profiles, fluctuation magnitudes and shear stresses will be measured. Relevance -this work is relevant to a number of MICOM activities since the turbulent boundary layer is an important element of missile aerodynamics. In addition, the proposed work supplements the turbulent boundary layer research, including turbulence measurements using hot wire anemometry, now being conducted at the Exterior Ballistics Laboratory of the Ballistic Research Laboratories.

A well-calibrated continuous Mach 3 air wind tunnel will be utilized to generate a supersonic boundary layer on a flat plate. The hot-wire anemometer will be used for making temperature fluctuation measurements for a range of wall temperatures and the cross-wire technique will be used for measurement of shear stresses.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0010, RESEARCH ON NEW APPROACHES TO OPTICAL SYSTEMS FOR INERTIAL ROTATION SENSING

M. CHODOROW, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (DF044420; AF-AFOSR-3070-76)

AF function - navigation, guidance and control of aircraft, spacecraft and missiles require sensors of angular rotation rate in inertial space. Deficiency - the coming use of ringlasers in platform and strapdown systems poses problems of cost, size and reliability. Objective - the intrinsic limitations of the ringlaser are to be avoided by new approaches to angular rate sensing using optical means. How work contributes - this research should lead to devices which are free from lock-in and bias effects usually encountered in conventional laser gyros, while still allowing rotation sensing with high sensitivity and accuracy as well as ready adaptation to specific requirements such as size reduction, cost decrease or sensitivity increase, by utilization of different operational modes and adaptation to vehicle geometry.

The new approaches are based on the Sagnac effect as in the ring laser, but involve modification to the classical Sagnac procedure consisting of use of multi-turn loops, modulation of the external optical source, use of inertial amplification in the loop and use of photo detector phase comparators for read-out. Optical fiber waveguides appear promising for constructing multi-turn rotation sensing loops for navigation of vehicles having unique geometrical advantages. Accuracies of the order of 10 sup -4 deg/hour are in prospect for measuring rotation of large vehicles. Multiple-turn paths using off-axis confocal mirrors provide an alternative, which would be viable on applications involving small-diameter paths where mirror systems would be acceptable. This first phase of the investigation will concentrate on proving the principles of the new approach using only passive loops.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, IMPLANTATION-CONTROLLED DIFFUSION OF IMPURITIES IN COMPOUND SEMICONDUCTORS WITH APPLICATION TO THE FABRICATION OF MICROWAVE DEVICE

J.F. GIBBONS, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DA0J5575; DAHC04-75-G-0156)

To obtain a physically satisfactory model of substitutional and interstitial diffusion mechanisms in 3-5 compound semiconductors. Relevance - this research contributes to the technology base of electronic semiconductor materials used in high-frequency communication, radar, fire control and night vision devices as attested by reviewers from ECOM, HDL, and NVL.

Study enhancement and inhibition of individual diffusion processes during direct diffusion, proton enhanced diffusion, ion implantation and coimplantation (vacancy control).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0012, OPTIMAL DATA COMPRESSION ALGORITHMS

M.E. HELLMAN, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF036900; F44620-73-C-0065)

AF function - the design of communication equipment and systems. Modern methods require optimal coding and decoding for proper utilization of digital representations of signals. Deficiency - military communications requirements place huge demands on available frequencies and substantial power must be used to produce adequate signal-to-noise ratios. The quantity of message and telemetry traffic is so high that potentially dangerous backlogs are a common occurrence. Objective - to develop more efficient and lower cost encoding and decoding algorithms based on information theoretic and combinatorial techniques. How work contributes - the results of this research could result in significantly lower costs for communications systems, while simultaneously increasing transmission rates or reducing the bandwidth needed.

Emphasis will be placed on extending the theory of tree and trellis codes, which have been widely used in error control coding because of their great cost effectiveness. Recent results concerning sliding block codes will be applied in devising implementa-

tions of trellis codes, and also, therefore, of highly effective nonlinear filters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, DYNAMICS OF VORTICES AND SHOCK WAVES IN NONUNIFORM MEDIA

B. STURTEVANT, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DF048980; F49620-77-C-0107)

AF function - advanced weapons systems. Opportunity -understanding the behavior of vortex rings and propagation of weak shock waves through nonhomogeneous mediums. The large-scale structure of turbulent flows are regions where the vorticity is concentrated and fluid motion is highly organized and coherent. The vortex ring is the simplest example of this type of motion. Understanding of the behavior of the vortex ring will provide valuable insight into the behavior of any turbulent boundary layer. In the analysis of the scattering of a weak shock wave in a fluid the equations are reduced to those identical to the mean motions of turbulence. Thus the study of the scattering of a weak shock wave may provide insight into the nature of turbulence. Objective - to study experimentally the nature and behavior of ring vortices and weak shock waves scattered by a nonhomogeneous medium. How work contributes -understanding of the dynamics of ring vortices and the propagation of nonlinear disturbances through a random atmosphere is essential to the understanding of turbulent boundary layers. This understanding has application in efficient air frame and wing design, the ability to produce more efficient combustion systems for advance power plants and gas dynamic lasers, the understanding of blast waves and sonic booms, in short, almost every fluid flow problem of interest to the Air Force.

A sharp, strong vortex ring will be produced by a shock tube. The characteristics and behavior of the vortex including the onset and type of instabilities will be studied using Schlieren and shadowgraph photography. A spark will be used to mark a portion of the fluid to evaluate velocity components and circulation of the vortices. Different turbulence conditions will be generated in a shock tube and the characteristics of a weak shock propagating through the medium will be studied using shadowgraph and pressure transducers. A detailed comparison between the experimental observation and theoretical predictions will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, PROPERTIES AND BEHAVIOR OF EXPLOSION FIELDS AND PLASMA FLOWS

J.J. ROSCISZEWSKI, Air Vehicle Corporation, *San Diego, California* (DF024930; F44620-75-C-0021)

AF function - satellite surveillance communications and navigation, weapon delivery and defense, close air support, advanced plasma thrusters, electric power generators and chemical explosive devices. Deficiency - insufficient in-depth understanding of the properties and behavior of dynamics of explosion and implosion fields, flowing plasmas, magnetic nozzle plasma phenomena, and of flows with radiant energy exchange, and lack of reliable theoretical models and mathematical tools for predicting the properties and behavior of the phenomena. Objective -to understand and develop accurate theoretical and mathematical models describing the plasma dynamic, combustion, explosion, implosion and energy exchange phenomena associated with advanced plasma dynamic systems and conventional chemical explosive devices. How work contributes - will provide additional understanding and realistic analytical modeling of the properties and behavior of the plasma dynamic, explosion and implosion, combustion, and flows with energy exchange not now available, will aid in improvising meaningful experiments, and will contribute to establishing design criteria for advanced plasma dynamic systems and chemical explosive devices with optimized properties.

In this program, semi-analytical methods, including use of inner and outer expansion and variational techniques, will be applied to solving general problems of propagation of blast waves in nonuniform flow fields. Included will be application to the problems of (1) one-explosion propagating in the flow field created by another explosion, (2) explosions in magnetic fields, (3) explosions in unconfined combustible media, (4) radiation supported implosion and (5) combustion and laser-driven implosion waves moving into a nonuniform flow field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, PRACTICAL CONTROL ALGORITHMS FOR NONLINEAR STOCHASTIC SYSTEMS

D.L. ALSPACH, Oricon Corporation, *San Diego, California* 92122 (DF040520; F44620-75-C-0023)

AF function - design of Air Force aircraft control systems. Deficiency - uncertainties in the control system input along with the inaccuracies of the sensors used to measure performance caused degraded system performance. Objective - the objective of this research program is to develop better methods for handling systems where uncertainties result in significantly degraded performance. How work contributes -this research could produce practically implementable algorithms for controlling Air Force systems more accurately and efficiently.

The approach here will be to investigate systems where uncertainties make the system nonlinear. First, an investigation of the effects of already developed filters in the feedback loops of nonlinear stochastic control systems will be pursued followed by optimal or nearly optimal deterministic controls. This in effect will force the separate structure of the linear quadratic Gaussian problem on the more general nonlinear stochastic control problem but will make use of the latest developments in the field of nonlinear estimation. In particular, nonlinear measurements of basically linear systems will be investigated since the cost of transducers often increases markedly from the linearity constraint. It may be that the cost of a small computer in a control loop could be completely saved by a reduction in the cost of the transducers required. Second, the above results obtained from the first investigation along with knowledge of the shape of a posteriori densities will be used to investigate the effect of intelligent but nonoptimal probing signals. These signals could be used to learn the effects of separate modes of multi-modal densities and thus speed or even allow convergence of the estimation algorithm allowing adequate control.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, ADAPTIVE ESTIMATION OF INFORMATION VALUES IN CONTINUOUS DECISION MAKING AND CONTROL OF REMOTELY PILOTED VEHICLES

A. FREEDY, Perceptronics Incorporated, *Woodland Hills, California* 91364 (DF043820; F44620-76-C-0094)

AF function - the research is a continuation program of research and development directed toward evaluation of information needs in decision making and control of advanced aircraft. Deficiency - a quantitative and general technique for evaluating decision information needs in continuous control of advanced aircraft will fill the need for a general realizable instrument capable of analyzing, evaluating, and allocating available information for decision making in a variety of complex systems. Objective - the research will broaden the concept of real-time management of communications from RPV supervision to more general command and control contexts. It incorporates the current work on multi-attribute utility modeling, resulting in a continuous three-year effort. How research contributes - the program will result in aids for the real-time management of man-machine communications.

The proposed research will test the operational capabilities of model-based information evaluation and management. Also, the study will extend the aiding context to more generalized command and control situations. A series of experimental tests will be conducted to verify the various operational features of the simulation system, and to modify them as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0017, SATELLITE COMMUNICATIONS

V. ZURICK, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (90004057)

PROJECT OBJECTIVE: 1. To determine ERL satellite communication requirements and to demonstrate application of existing satellite facilities to fulfillment of those needs. 2. To formulate a long-range plan for implementation of satellite communication systems.

CURRENT YEAR PLAN: 1. Install on a temporary basis satellite terminals at NOAA Hdqtrs. and ERL Hdqtrs. for demonstration. 2. Negotiate working agreements with Univ. of Colo., HEW, VA, and NASA for cooperative use of their satellite communication facilities.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

4.0018, CALCULATION OF THE ENERGETICS AND COLLISION DYNAMICS FOR ELECTRONIC TRANSITIONS
H.H. MICHELS, United Technologies Corp., *Hartford, Connecticut* 06108 (DF047970; F49620-77-C-0064)

AF function - surveillance, reconnaissance, communications, weaponry. Deficiency - a sufficient knowledge of the energetics and dynamics of collisional processes is lacking for the discovery of electronic transition, chemically pumped lasers. Objective - develop reliable techniques for the computation of potential energy surfaces and develop sufficient information on the electronic energy levels, potential energy curves, radiative transitions probabilities and collisional kinetics of selected chemical systems. How work contributes - provides information for the evaluation of candidate systems as laser systems.

This investigation will be carried out, in part, using quantum mechanical methods and computation programs that have already been developed. The potential energy surfaces will include both atom-atom and atom-diatom systems with special emphasis on molecular reactions yielding electronically excited products. These systems shall include metal oxides and halides, metal excimers and noble-gas halides. This research will also develop techniques and computational schemes for a priori prediction of the kinetics and the product distribution of atom-diatom reactions. This will involve improved techniques for calculating potential energy surfaces for the reactants and products, quantum and classical mechanical calculations of the dynamics and detailed calculations for systems with high potential as electronic transition lasers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, INTERFACIAL CHEMICAL REACTIONS IN FLOW SYSTEMS
D.E. ROSNER, Yale University, School of Engineering, *New Haven, Connecticut* 06520 (DF029020; F49620-76-C-0020)

AF function - weapons delivery. Deficiency - materials technologies for reentry nose cones and heat shields, rocket nozzles, turbine and combustion chambers are seriously lacking in both theoretical understanding and reliable experimental data on basic gas-solid reactions at high temperatures. Objective - the research will provide to system and materials engineers theoretical understanding and fundamental data on interfacial rate processes, both for gas-surface and gas-particle interactions. How work contributes - over a number of years, this research has been building up a body of useful data and rigorous computational techniques for treating interfacial flow systems.

Theoretical problems include energy transfer to smooth, rough and porous surfaces, chemical reactions in flows over catalytic duct surfaces with non-circular cross sections, and nucleation zone structure in mixing layers. Experimental data will be obtained by the coaxial filament flow reactor (CFFR) for high-temperature reaction, dissolution and volatilization of refractory metals with nitrogen and oxygen molecules and atoms, and to further elucidate energy accommodation of surfaces which catalyze high-temperature gaseous reactions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, SUPERSONIC DIFFUSER RESEARCH
P.P. WEGENER, Yale University, School of Engineering, *New Haven, Connecticut* 06520 (DF036170; F49620-77-C-0068)

AF function - weaponry. Deficiency - supersonic diffusers for flowing gas lasers do not give adequate pressure recovery within the size and weight limitations required for all applications. Diffuser design depends too much on cut-and-try methods. A more systematic understanding of diffuser operation would permit the necessary improvements to be made. Objective - to investigate systematically the interacting physical phenomena involved in the operation of a simple type of diffuser and to explore means of using the information gained for making substantial improvements in performance. How work contributes - the working gas in some laser cavities is considerably below atmospheric pressure. It must be dumped into the atmosphere by a combination of diffuser pressure recovery and pumping. Efficient diffuser performance is crucial to the ability to keep the entire system weight within the usable range.

In Ludwieg tube experiments, starting time and pressure recovery measurements will be extended to rectangular duct, constant area diffusers formed by one or more separating walls built into the square test region. Experiments will continue also to investigate nonequilibrium flows and boundary layer suction effects in diffusers. A theoretical effort will be made to take into account sub-features of the flow, along with experimental data, in order to determine whether diffuser losses can be better understood by lumping them into categories such as shock losses and friction losses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, RECORDER TAPE GUIDANCE AND DRIVE MECHANISM ANALYSIS
G. BORDS, Howard University, Graduate School, *Washington, District of Columbia* 20001 (NAS 5-24422)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0022, SUMMER FACULTY FELLOWSHIP PROGRAM
UNKNOWN, Howard University, Graduate School, *Washington, District of Columbia* 20001 (NGT 09-011-060)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0023, CALCULATION OF TIME-DEPENDENT FLOWS WITH REVERSAL AND SEPARATION 14039-EX
J.F. NASH, Sybucon Incorporated, *Atlanta, Georgia* 30339 (DA0E9166; DAAG29 76 C 0045)

To perform fundamental investigations on the behavior of unsteady compressible turbulent and laminar boundary layer and boundary layer-like flows experiencing local reversal and approaching full separation. The proposed investigation is directly relevant to the ongoing program of research at the AMRDL on the analysis of dynamic stall of helicopter rotors.

An implicit numerical method based on the alternating-direction method will be developed for calculating unsteady separating turbulent viscous flows which are described by the turbulent kinetic energy equation model. This tool will be utilized in describing the response of unsteady flows to changes in the governing physical parameters and boundary conditions.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0024, NAVY VEHICLE DESIGN AND CONSTRUCTION - VORTEX/WING VISCOUS INTERACTION THEORY AND ANALYSIS
C.J. DIXON, Lockheed Georgia Company, *Marietta, Georgia* 30060 (DN475229; N00014-74-C-0151)

The objective is to expand the understanding and knowledge concerning the creation, development and stability of leading edge and other wing intersecting vortices, and to develop the analytical tools to explore these phenomena for the design of tactical aircraft wings, utilizing optimized wing-vortex interactions for improved aerodynamic efficiency.

The approach is to refine and improve the viscous numerical model developed under the contract, and to use that model to investigate the effects of parameters such as vortex formation, strength, position, growth or decay, and incipient burst, on the lifting-surface interacting vortex. Specific knowledge concerning the critical leading edge conditions and typical boundary conditions is to be obtained through wind tunnel tests. Coupling the viscous numerical model with a potential flow model to provide complete aircraft forces and moments is to be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0025, TURBINE ENGINE HIGH-FLOW COMPRESSOR

P. TRAMM, General Motors Corporation, *Indianapolis, Indiana* 46206 (DF453640; F33615-72-C-1233)

Advance the state-of-the-art in transonic/supersonic, high-throughput flow compressor technology while increasing loading to levels beyond current advance efforts.

Design, fabricate, instrument, assemble and test compressor vehicle. Trade studies will be conducted to establish compressor configuration layout. A distortion sensitivity test program will also be executed along with preliminary engine design and layout.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

4.0026, INVESTIGATION OF ELECTROMAGNETIC WAVES ON SUPERCONDUCTING MAGNETS AS MECHANISM OF POTENTIAL COIL DAMAGE

G.J. GABRIEL, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (NSG 3182)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0027, MULTISTAGE AXIAL-FLOW TURBOMACHINE WAKE PRODUCTION, TRANSPORT AND INTERACTION

T.H. OKIISHI, Iowa State Univ. of Sc. & Tech, School of Engineering, *Ames, Iowa* 50011 (DF042140; AF-AFOSR-2916-76)

AF function - advanced turbomachinery. Opportunity - improve understanding of flow through an axial flow turbojet engine. Objective -obtain a better understanding of the fluid flow physics related to multistage, axial flow turbomachinery. How work contributes - a better understanding of the fluid flow will improve our ability to produce competent turbomachine configuration designs.

The effort is primarily an experimental study using a low Mach number, three-stage axial flow research compressor. Detailed flow field data will be obtained and analyzed. The research results will then be incorporated into turbomachine design procedures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, THREE-DIMENSIONAL BOUNDARY LAYERS AND THE ORIGIN OF LIFT ON BODIES OF REVOLUTION AT INCIDENCE 13054-E

V.C. PATEL, Univ. of Iowa, School of Engineering, *Iowa City, Iowa* 52240 (DA0R5570; DAAG29 76 G0036)

To make a comprehensive experimental and theoretical study of the three-dimensional turbulent boundary layer on a body of revolution at several angles of attack with a view to provide a rational explanation for the origin of lift. The proposed research task is directly applicable to a current AMRDL-Eustis program to develop an analytical method for modeling flow separation on three-dimensional bluff bodies. The objectives are also relevant to the MICOM technology areas directed toward the development of methods for determining aerodynamics of missiles at high angles of attack and to experimental and theoretical boundary layer research now being carried out at the Exterior Ballistics Laboratory of BRL.

Pressure distributions and associated boundary layer development will be measured on a body of revolution at several incidences to identify locations of vortex formations and boundary layer separation lines. Results will be compared with a finite-difference calculation method developed for this flow situation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0029, INTERNAL GRAVITY WAVES GENERATED BY VORTEX WAKES

S.C. TRAUGOTT, Martin Marietta Corporation, *Baltimore, Maryland* 21227 (DF040020; F44620-75-C-0009)

AF function - air vehicles. Opportunity - in many Air Force functions (logistic support, air drop of men and material, quick reaction of a large number of aircraft, etc.) it is necessary to operate aircraft in highly congested areas. The ability to accomplish this safely and economically requires a detailed understanding of an aircraft's flow field and how it interacts with other aircraft and the environment. One aspect of this problem is the trailing vortex produced by an aircraft's flight through the atmosphere. The possibility exists that aircraft wakes will act as a source of internal gravity waves in the atmosphere. If aircraft were to be an important source of such waves, these might then have a significant influence on local stratospheric structures by triggering alterations in turbulence, transport and mixing. There is also the question of what the possible impact would be on other aircraft. Objective - the objective of this research is to delineate those conditions of atmospheric structures and air vehicle characteristics that would give rise to internal gravity waves in the atmosphere. How work contributes - the analysis necessary to assess the efficiency and strength of internal gravity wave generation from buoyant wakes in a stably stratified atmosphere needs to deal with a number of complex, closely coupled phenomena. Not surprisingly, only a few attempts to address this problem have been reported in the literature and these need to rely on a great many simplifying assumptions. This effort employs a numerical, finite-difference solution of the Navier Stokes, coupled with the Bousinesque form of the energy equation. Work completed to date offers some intriguing hints that previous analytical work may possibly have resulted in predictions whose validity is broader and more general than the restrictive assumptions needed to derive them.

This effort proposes to investigate, primarily by numerical techniques, the interaction of the aircraft wake and a stratified environment with particular emphasis on the effects of wake buoyancy, wake collapse, and ambient stratification. The generation and propagation of gravity waves, arising from wake collapse and vertical wave motion driven by the lifting vortex pair and net buoyancy, will form the major thrust of this study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, 20 KILOWATT TDMA SOLID-STATE TRANSMITTER

R. GARDHENGI, Westinghouse Electric Corp., *Baltimore, Maryland* 21203 (DF742430; F30602-76-C-0318)

It is an objective of this program to develop, fabricate and evaluate a solid-state power amplifier capable of providing 20 kilowatts peak power at 3 per cent duty and 2 millisecond pulse width for use in TDMA SATCOM communication systems.

The system specifications will be met by combining the outputs of on-the-shelf devices capable of 300 watts per device at the frequencies of interest. These devices will be parallel combined in a sub-module capable of at least one kilowatt peak power output and the sub-modules will be parallel in a high-power hybrid combiner to produce the required 20 kilowatts. Included in the program will be a reliability study, thermal analysis and a cost comparison based on production costs, life cycle costs and impact of utilizing low-voltage, high-current power supplies versus high-voltage lower current power supplies. The end item will be a

bread-board model 20 kw amplifier for evaluation in RADC TDMA experimental equipment and a final report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0031, A LOW-COST GUIDANCE & CONTROL METHOD FOR AN ATTACK HELICOPTER AIR-TO-AIR WEAPON

B.H. SCHEINER, U.S. Army, Harry Diamond Laboratories, *Hyattsville, Maryland* 20783 (DA0F5700)

The objective is to study the feasibility of a low-cost module containing an imager, guidance and control functions, and a fuze. This module would be used on rockets fired from helicopters, and would operate in one of two modes - as a semiactive laser guided weapon if a laser designator illuminated the target during the entire flight, or as an 'intelligent' target homing device when the target is illuminated by a laser for a short time before the rocket is launched. In the latter, mode, the module would allow a 'fire and to get' capability with a significant effectiveness against both helicopter targets and heavy materiel on the ground.

A solid-state charge-coupled imaging array with suitable filters and optics would be used as the target seeker. A microcomputer system would be programmed with a scene analysis algorithm capable of using the information from the seeker to generate guidance control signals to the control section. Vehicle control would be provided by vectored fluidic gas reaction jets. A remote set capability would provide energy for initial power-up as well as relay information from the pilot. Given this information, the proximity sensor mode optimum for either air or ground targets would be selected.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Harry Diamond Lab.

4.0032, DIELECTRIC LAYER FILTER

UNKNOWN, Raytheon Company, *Bedford, Massachusetts* 01730 (DF901100; F19628-77-C-0111)

AF function - satellite-to-aircraft communication. Deficiency -improved antenna performance by spacially filtering grating lobes inherent with widely spaced array elements. Objective - to determine a general method for locating pass and stop zones to eliminate any possible grating lobe combinations. How research contributes -elimination of grating lobes allows large arrays to be made using less elements, reducing array cost, weight, and complexity.

The approach is to seek out innovative general mathematical techniques that will provide specific pass regions and stop regions in angle. This is an angular synthesis problem.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0033, RESEARCH LEADING TO THE DEVELOPMENT OF INSTRUMENTATION FOR RESEARCH ROCKETS SUPPORT AND INSTALLATION AT ROCKET LAUNCH SITES

S.J. ROCHEFORT, Northeastern University, School of Engineering, *Boston, Massachusetts* 02115 (DF247220; F19628-76-C-0111)

AF function - research leading to the development of state-of-the art airborne instrumentation systems. Deficiency - the inability to accurately forecast the atmospheric interactions affecting the design and operation of military systems in the area of rockets and satellites. Objective - to perform studies leading to the design, construction and flight test of state-of-the-art airborne instrumentation systems. Such studies will attempt to improve present-day systems by more efficient utilization of transmission bandwidths. Provide field support - carry on post-flight analysis of performance and provide continuing improvement. How research contributes - the development of more efficient airborne data processing techniques and instrumentation systems will allow more efficient use of RF bandwidth within the limited allowed band.

Theoretical development of more efficient telemetry systems for use in rocket, satellite and balloon instrumentation systems. Construct these telemetry systems for flight - provide field support - carry on post-flight analysis of performance. The closed loop will ensure rapid response to current need and the design objectives of space, weight and power. The vast experience accumulated through previous contracts should ensure efficient use of valuable Air Force funds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0034, HIGH-LEVEL AIRDROP TECHNOLOGY

E.J. GIEBUTOWSKI, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0F4311)

To investigate technological problem areas likely to arise in adapting the technology developed in the high-level container airdrop system (HLCADS) (the 6.3 program in FY73) to the more extensive mission of dropping personnel and platform loads from as high as 10,000 feet AGL or higher. To determine and investigate other technological barriers to broad-spectrum high-level airdrop missions not encountered in the HLCADS effort. The final goal will be to acquire a technological base suitable for supporting the formulation of a system configuration capable of airdrop of personnel and platform loads from altitudes above the threat of hostile ground fire.

The initial approach will be to apply the analyses of critical opening velocities and staging characteristis of large clustered parachutes conducted under the 'airdrop technology' subtask to the solution of high-level airdrop technological barriers. Exploratory flight tests will be conducted to confirm and extend the analytical findings.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0035, FINITE-ELEMENT SOLUTIONS TO TRANSONIC FLOWS IN AXIAL FLOW TURBOMACHINES

S.S. WANG, Univ. of Mississippi, School of Engineering, *University, Mississippi* 38677 (DF043320; AF-AFOSR-2982-76)

AF function - advanced gas turbine engine technology. Deficiency -lack of fundamental knowledge on flows through axial flow compressors. Objective - develop a numerical solution technique which can handle transonic flows through turbomachinery. How work contributes - better knowledge of flow fields through turbomachinery will allow designers to improve present empirical techniques used today in designing advanced turbomachinery compressors.

A numerical solution technique based on the finite-element method for solving the fluid flow through an axial flow compressor will be developed for blade-to-blade flow. Once blade-to-blade flow has been shown to be solved, the results will be applied to the solution of meridional plane flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, DEVELOPMENT AND VERIFICATION OF SIMULATION MODELS FOR ANALYZING ORBITER DIGITAL COMMUNICATIONS AND DATA LINKS

W.H. TRANTER, Univ. of Missouri, School of Engineering, *Columbia, Missouri* 65201 (NAS 9-15477)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0037, NAVY VEHICLE DESIGN AND CONSTRUCTION - VISCOUS FLOWFIELDS AND AIRFRAME FORCES INDUCED BY TWO-DIMENSIONAL LIFT JETS IN GROUND EFFECT

D.R. KOTANSKY, McDonnell Douglas Corporation, *St. Louis, Missouri* 63166 (DN675330; N00014-76-C-0494)

Develop the numerical techniques for predicting viscous, turbulent flow produced by the operation of high-performance lift-jet VTOL aircraft in ground effect. These techniques will provide fundamental information on jet entrainment, temperature and velocity decay, and ground jet growth. This information will per-

mit accurate prediction of induced forces acting on the airframe which are required for propulsion system sizing and aircraft stability and control analysis.

The time averaged Navier-Stokes equations with an appropriate one-equation turbulence model will be solved for steady, 2-d, compressible, turbulent, vectored and unvectored impinging jets from fuselage-like bodies. The flowfield solutions for seven configurations will be compared with data from tests being conducted by McDonnell Douglas Research Laboratories and the computation model will be improved as required.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0038, UNSTEADY TRANSONIC FLOWS IN A TWO-DIMENSIONAL DIFFUSER

M. SAJBEN, McDonnell Douglas Corporation, *St. Louis, Missouri* 63166 (DF048360; F49620-77-C-0082)

AF function - advanced aerospace vehicles. Opportunity - increase our fundamental knowledge of the parameters which cause dynamic inlet distortion (fluctuations). Objective - experimentally explore the effects of approach boundary layer properties on the unsteady behavior of two-dimensional, transonic diffuser flow. How work contributes -understanding of the mechanisms responsible for the flow unsteadiness will provide the basis for establishing scaling laws and developing inlet-compressor matching methods that are based on fundamental principles of fluid mechanics.

Appropriate hardware will be designed and built to permit varying the thickness of the boundary layer approaching the inlet throat. A matrix of test parameters will be established adequate to cover all significant fluctuation modes. Oil flow traces and high-speed Schlieren movies will be used as visualization techniques. All data will be analyzed and correlated with the visual information contained in the movies and oil traces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0039, AERIAL REMOTE SENSOR DATA COLLECTION PROCESSING AND ANALYSIS FOR ENVIRONMENTAL MONITORING

F.G. CLAWSON, U.S. Environ. Protection Agcy., Env. Monitoring & Support Lab., *Las Vegas, Nevada* 89114 (68-03-2153; J620A-51)

The purpose of this contract is to provide continuing on-site support for the two major activities of the Remote Sensing Division. Evaluates new and existing concepts for methods of remote sensing measurement. Designs and constructs electrooptical instruments for the remote detection and measurement of specific physical and chemical pollutants. Evaluate and field test remote sensing instruments for specific chemical and physical pollutants. Develop and evaluate automated data systems and applicable software for analysis of test data and analyze test results in terms of meeting design objectives and criteria. Plan and conduct aerial data collection missions including all phases of the mission, except operation of the aircraft. Maintain and calibrate instrumentation and data systems. Provide remote sensing required in oil and hazardous material spill response situations. Develop and verify mathematical models for the analysis of land use and water quality data. Operate and deploy the airborne MSS instrument for the acquisition of digital spectral reflectance measurements of land and water surfaces. Operate and maintain multi-spectral data analysis system (DAS) which is designed to automate the analysis of digital remote sensing data. Develop and operate programs for multi-spectral data analysis. Operate photo-processing facilities to produce final imagery for interpretation and project reports. Interpret aerial photography and imagery to extract environmentally significant information. Prepare final product reports to include cartography and drafting.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

4.0040, ACQUIRE FROM NASA AND PUT INTO USE, THE DATA ANALYSIS SYSTEM (DAS) FOR MULTISPECTRAL INFORMATION

M. DOCKTER, U.S. Environ. Protection Agcy., Remote Sensing Division, *Las Vegas, Nevada* 89114 (J625C-70)

OBJECTIVES: a) Training of EMSL-LV Remote Sensing Division personnel by NASA in the use of the automated multispectral analysis system. b) Acquire from NASA and put into operational use the Data Analysis System, c) Perform analysis and prepare a final report on completion of the transfer of technology.

APPROACH: The training of EMSL-LV Remote Sensing Division personnel on the actual DAS with operational type requirements will greately enhance the NASA to EPA technology transfer. The DAS was designed with the capability to reduce a broad range of remote sensor data and will be used to reduce the multispectral scanner and ERTS data for land use mapping and water monitoring purposes. The DAS output may be recorded on nine track digital computer compatible tape for further processing, displayed on a high-resolution color television monitor, recorded on 9.5 inch wide color or black and white film, or listed on a high-speed line printer. A versatile interactive operator control console is included to provide complete operator-processor communication and control.

CURRENT PLANS/PROGRESS: a) Demonstration of technique using existing NASA system (complete). b) Training of EMSL-LV personnel (October 1976 to July 1977). 3) Acquire complete DAS system for EMSL-LV (June 1976 to September 1977).

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

4.0041, DISTURBANCE ACCOMMODATION CONTROL RESEARCH

J.A. SCHMITZ, U.S. Army, Small Caliber Weapon Sys. Lab., *Dover, New Jersey* 07801 (DA0Q1609)

Establish simple effective control laws using feedback control and disturbance accommodation techniques for application to helicopter turret and tank control systems with broad class of disturbances.

The main performance objective of a feedback control system is to maintain a set-point regulation or to cause the system output to follow an input command. This means that the control system must perform satisfactorily every time and not in the average. The statistical properties of system disturbances are used in stochastic optimal control, thus giving average properties of the system process. This results in a satisfactory average performance although the system may fail to give acceptable individual performance. Control system using a priori waveform modes of the expected broad class of disturbances will be able to maintain tight regulation and close tracking at all times. This method, called disturbance accommodation (DA), makes the feedback controller provide (1) a cancelling control signal or disturbance adaptive and (2) feedback for regulation. This DA method will be investigated and generalized for weapon system implementation.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab.

4.0042, SEPARATED FLOW AND TURBULENT BOUNDARY LAYER RESEARCH

S.M. BOGDONOFF, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DF041440; F44620-75-C-0080)

AF function - aerospace vehicles. Deficiency/opportunity - turbulent boundary layers and separated shear layers in supersonic flow are commonplace on airplanes, engine inlets and internal flow passages. Hypersonic turbulent boundary layers occur on reentry vehicles. In both cases the aerodynamic and heat protection design is often dominated by the necessity of coping with the turbulent boundary layers or the possibility of their occurrence. More complete understanding of these boundary layers could improve the design procedures and make it possible to build less

costly and more effective aerodynamic and heat protection components. Objective - to conduct experimental studies in the following areas: (1) shock-wave interactions with turbulent boundary layers, (2) reattaching turbulent shear layers, (3) incipient flow separation, (4) Mach 16 turbulent boundary layer and (5) flow field survey about a yawed cone at Mach 25, also to extend the capability of the electron beam fluorescence turbulence measurement technique to higher gas densities. How work contributes - increased understanding of the phenomena in these problem areas will permit significant improvement in designs of aerodynamic and thermal protective components of aerospace vehicles. Improvements may be in the form of increased vehicle capabilities or better cost effectiveness.

Experiments will be performed in supersonic and hypersonic flows of air, helium, and nitrogen in the extensive gas dynamics laboratory facilities at Princeton University.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0043, INTERNAL COMBUSTION ENGINE FLAME PROPAGATION AND EMISSIONS (TURBULENCE MODELING AND LARGE-SCALE EDDY RESOLUTION)

W.A. SIRIGNANO, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (NSG 3178)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0044, MULTIPLE IGNITION, COMBUSTION AND QUENCHING OF HYDROCARBON FUEL SPRAYS

W.A. SIRIGNANO, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DF044230; AF-AFOSR-3041-76)

AF function - weapon delivery and defense, aircraft component vulnerability and survivability. Deficiency - insufficient understanding of the basic physical, chemical and fluid dynamic processes of multiple ignition propagation, attenuation and quenching of flames and detonations in reactive hydrocarbon-air fuel sprays and mists and lack of realistic guidelines for predicting properties and effectiveness of potential flame/detonation quenching techniques. Objective - to clarify the relative influence and to formulate realistic analytical representation of the mechanisms responsible for multiple ignition by hot metal particles, combustion, detonation and quenching of hydrocarbon fuel sprays and mists occurring in air-breathing propulsion system dry bay and fuel tanks. How work contributes - will provide additional understanding of, and analytical models realistically describing the initiation, combustion propagation, attenuation and quenching mechanisms of flames and detonations in reactive media not now available and will contribute to establishing realistic guidelines for minimizing the ignition probability, for developing of effective flame and detonation arrestors and in general, reducing aircraft vulnerability and increasing survivability.

Mechanisms for ignition, combustion, and quenching of hydrocarbon fuel sprays occurring in the dry bay and fuel tanks associated with air-breathing propulsion systems will be examined. The emphasis will be on the basic physical, chemical, and fluid mechanical phenomena. The relative importance of various mechanisms will be considered; initially, hot metal particle clouds would be given special consideration as multiple ignition sources, with emphasis on aluminum and magnesium systems. Both deflagration and detonation combustion phenomena will be considered. Experimental facilities and instrumentation will be established to simulate the practical phenomena of interest. Any deficiencies in existing models will be demonstrated. Improved models will be formulated on the basis of existing experimental data and field observations. Parametric studies will be made to determine the most important parameters and their influences on the ignition, combustion, and quenching phenomena. The experiments will be revised on the basis of theoretical results. The predictive capability of the theory will be established.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0045, ANALYTICAL MODELING OF FLASHBACK PHENOMENA

C. FENG, Trenton State College, Graduate School, *Trenton, New Jersey* 08625 (NSG 3180)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0046, HYDROGEN-PUMPED IODINE LASER

J.A. BLAUER, Bell Aerospace Company, *Buffalo, New York* 14240 (DF187160; F29601-76-C-0063)

The objective of this work is to develop a high-energy, chemically pumped, electronic transition laser. Detailed studies of the H and HI reaction will be used to investigate energy transfer from vibrationally excited hydrogen molecules to iodine atoms and to demonstrate lasing by electronically excited iodine atoms at 1.315 microns.

Atomic hydrogen will be generated by shock heating mixtures of H(2) and AR to 4500K. The hydrogen atoms will be expanded out of the shock tube through a nozzle where HI will be injected into the flow. Optimum cavity conditions will be sought to demonstrate lasing. Other techniques to generate sufficient flows of hydrogen atoms will be pursued. Other energy transfer systems will be evaluated as to their potential for high-energy, chemically pumped, electronic transition lasers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0047, TACAN/DME DEVELOPMENT

UNKNOWN, Sierra Research Corporation, *Buffalo, New York* 14225 (FA75WA-3634; FA058611 (TRAIS NO.))

Project includes: 1. The study and analysis of specific and general problems involving TACAN/DME system operations; 2. The design and development of TACAN/DME ground and avionics equipments including modifications thereto; and 3. The evaluation and validation of specific equipments and concepts.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0048, ADVANCE DEVICE PROCESSING TECHNIQUES

J.H. BLOOM, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13440 (DF902780)

AF function - communications and reconnaissance. Deficiency/opportunity - solid-state components are too expensive. Objective - research new device processing techniques that improve the control and tolerance attainable in solid-state device fabrication. How research contributes - solid-state devices that are fabricated with processes that require reduced tolerance margins can be made cheaper due to increased yield and/or increased functional complexity per chip.

Electron beam exposures of electron resists, ion implantation doping, plasma and ion etching, and electron beam evaporations as well as ion sputtered thin films will be investigated for use in solid-state device fabrication. Fundamental physics of low barrier height Schottky barrier will be investigated as a function of processing techniques. Electron beam dose requirements for submicron linewidth will be investigated as a function of available electron resist sensitivity and substrate material, i.e., semiconductor, metal or insulator. Ion implantation doping of InP and various ternary compounds will be carried out to determin doping efficiency as a function of annealing temperature and capping material. Plasma and ion beam etching will be investigated in order to increase uniformity of the etched layers and improve selectivity. Various thin film techniques will be utilized to improve the junction quality of low work function Schottky barriers on silicon and to produce capping layers for III-V compounds semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0049, RESEARCH ON MICROWAVE JUNCTION-GATE FIELD EFFECT TRANSISTORS 13586-EL

S.K. GHANDHI, Rensselaer Polytechnic Inst., School of Engineering, *Troy, New York* 12181 (DA0E9120; DAAG29 76 G0172)

To investigate and improve junction field effect transistors in III-V compounds. Relevance - electronic III-V compound devices permit operation into tens of gigahertz - junction gate field effect transistors are expected to be more reliable than presently used Schottky gate field effect transistors. Vital relevance to communication/navigation satellites, tactical communication links, missile guidance, EW equipment.

To study basic problems associated with the growth and characterization of the channel layer, and with obtaining an improved understanding of diffusion and masking problems associated with the junction gate.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0050, PRE-COOPERATIVE ENGINEERING EDUCATION PROGRAM

J. BROWN, Univ. of Cincinnati, Graduate School, *Cincinnati, Ohio* 45221 (NGT 36-004-780)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0051, IMPLICIT FINITE-DIFFERENCE SCHEMES FOR SUPERSONIC COMPRESSIBLE VISCOUS FLOWS

M.J. WERLE, Univ. of Cincinnati, School of Engineering, *Cincinnati, Ohio* 45221 (DF137190; F33615-76-C-3091)

Efficiency is lacking in the present (explicit) prediction methods for solving viscous flow problems. The objective of this investigation is to develop an implicit finite-difference scheme for solving the complete Navier-Stokes equations. If successful, the numerical method can become faster and less expensive to employ than wind tunnel testing, thereby shortening the systems development cycle.

A numerical technique will be developed employing an implicit solving scheme for the Navier-Stokes equations. This approach circumvents the severe stability limit required of the explicit methods and potentially reduces the computational time by an order of magnitude. A computer-time comparison shall be performed for both the explicit and implicit schemes for the case of a supersonic shock boundary layer interaction. These investigations shall produce computer programs useful for the design of aerospace systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0052, COMMUNICATIONS - A FUNDAMENTAL INVESTIGATION OF A HYBRID THEORY FOR GENERAL ELECTROMAGNETIC SCATTER AND ANTENNAS

G.A. THIELE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DN675287; N00014-76-C-0573)

A general theory, valid at the high-frequency limit, the low-frequency limit, and near resonance will be developed to determine antenna impedance and radiation patterns from bodies of complex shape such as Navy ships, aircraft, and missiles. The theory will simplify treatment of slot antennas and conformal slot arrays, as well as calculation of radar cross sections of bodies with wire or rod appendages such as satellites.

The method of moments theory and geometric theory of diffraction will be combined into a unified hybrid theory. The method of moments will be extended by separately determining the contributions to the impedance matrix in the spatial regimes where the method of moments and geometric theory of diffraction respectively apply.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0053, THERMAL ENERGY STORAGE AND HEAT TRANSFER INVESTIGATION

J.E. BEAM, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF458500)

To develop the required analytical and experimental heat transfer and metallurgical compatibility data necessary to optimize the design and useable life for surveillance spacecraft VM cryocooler applications.

A two-phase program is proposed. Phase I concerns analytical modeling of transient cycling of cylindrically encapsulated TeS phase change materials, setting up an in-house test capability to allow thermal cycling of liquid metal heat pipes with integral TeS, and initiating invacuo metallurgical clad/TeS compatibility tests. Phase II centers on calorimetric testing and cyclic performance mapping of subscale thermal trains and contractual end item hardware.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

4.0054, SAR DATA ANALYSIS

R.T. COKER, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF097850)

To provide quantitative information on the smoothing effects of non-coherent integration of SAR data as functions of transmit frequency, azimuth angle, transmit-receive polarizations, flight path characteristics and target-background categories. The digital data used for fundamental radar parameter evaluation will also be investigated for other types of post-correlation radar processing such as polarization ratioing, azimuth and frequency discrimination.

SAR data from the polyfrequency radar which has been optically correlated and digitally recorded on magnetic tape will be the main data base for this study. This data will contain three multilook diversity dimensions consisting of four transmit frequencies by 15 azimuth aspects, by four transmit-receive polarizations. Multilook data will be digitally formed from this data base by non-coherent integration. Techniques such as polarization ratioing will also be investigated. This analysis will be done for a wide spectrum of hard targets and diffuse surfaces. The analysis will also be a function of depression angle, as well as depression and azimuth angle changes. The approach is more completely described in a detailed plan dated Jun 73, 'a plan to determine the quantitative effects of frequency, azimuth, and polarization on synthetic aperture imagery'.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0055, REAL TIME ELECTRO-OPTICAL SENSOR PERFORMANCE PREDICTION

H.E. GELTMACHER, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF101480)

To further develop and refine e-o sensor performance models developed under 69DF ADP, specifically, (1) refine models to accurately predict lab-measured parameters such as video SNR vs. target status, (2) refine lab measurement techniques and instrumentation to accurately measure sensor model input/output parameters, (3) refine and develop models to accurately predict observed human plus sensor performance in lab vs. target status, (4) include most valid and accurate atmospheric models available to compute and predict effects of angular dependent scattering, absorption, turbulence, and discrete conditions such as atmospheric layers, (5) demonstrate ability to predict observed performance in real world (tower tests), (6) demonstrate ability to predict observed performance in real tactical situations with typical tactical targets under a wide variety of weather and climatic conditions (flight tests).

The program will be performed by AFAL/RWI using IH specialists. (1) Models developed under 69DF will be programmed to run on IH computer and refined to include latest available technology. Results will be compared with lab measurements using Westinghouse active LLLTV system and AAD-7 FLIR, (2) Model parameters will dictate required measurements and necessary new instrumentation will be purchased or developed on contract, (3) Parameter coefficients including effects of human (eye MTF, brightness, magnification) will be determined empirically

by curve fitting observed performance data obtained in the lab, (4) support from AFCRL and AFAL staff. We will provide the best available model as a basis for experimental verification and further development to include atmospheric effects, (5) AFAL tower facility and Trebein targets will be utilized for outdoor testing and development, (6) WPAFB, Eglin, PAX RWER, and other sites will be used for flight test verification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0056, FABRICATIONS AND INVESTIGATIONS OF NICKEL-CADMIUM CELLS FOR AEROSPACE POWER SYSTEMS

D.F. PICKETT, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF452180)

The objective is to acquire an in-house capability for fabrication of Ni-Cd cells, and cell components and to use this capability via innovative experiments to provide improved aerospace Ni-Cd batteries.

The technical approach being followed in this in-house effort is (a) establish charging efficiency for state-of-the-art cells, (b) establish parameters for a one-step electrochemical loading of electrodes with active material, (c) fabricate 20 cells using electrochemical methods and performance test, (d) publish reports on events, (a), (b), and (c), (e) fabricate nickel electrodes for nickel-hydrogen and nickel-zinc cells, (f) publish report on event (e), (g) repeat (c) for 200 cells having various plate additives and constructions, and (h) publish report on event (g).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

4.0057, CRF FLOW QUALITY INVESTIGATION

R. RIVIR, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF460540)

The primary objectives of this program are to determine the steady-state and dynamic distortion levels within the test chamber and the compressor bell-mouth of the compressor research facility (CRF) and to develop techniques to reduce these levels to acceptable values.

A series of tests are being carried out on a one-tenth scale model of the CRF using global Mach number scaling with flow control elements employing Reynolds number similarity. Current and planned distortion tests involve parameters such as pressure, temperature, velocity, and flow direction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

4.0058, INTEGRATED CIRCUIT TECHNIQUES

J.F. SKALSKI, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF085700)

To provide an in-house technology base in the form of an integrated circuit fabrication facility, to develop the necessary processing techniques for LSI high-speed circuits required in advanced avionic subsystems. This will include both silicon and GaAs technology for circuit implementation. Maintain in-house fabrication capability to supply low-volume special military-applications devices in the areas of detector arrays, solar cell and MNOS memories.

Use of emitter-coupled logic techniques through the implementation of gate-array approaches for high-speed digital subsystems will be emphasized. Other commercially available gate arrays which employ bipolar and MOS technologies will also be exploited where speed/power allow for military system application. A GaAs technology base will be developed in-house to include the capabilities of ion-milling, sputter-evaporation of insulating films, and photo-resist/etch techniques for 1 micron line resolution. Continued development of unique large-area silicon precision, uniform low-crosstalk detectors, development of advanced design radiation-hardened solar cell for space application, development of improved MNOS processing techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0059, EFFECTS OF TURBULENCE ON GLOW DISCHARGE

F.D. STULL, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF456790)

To investigate the effects of turbulence on glow-to-arc transition in a flowing gas with emphasis on increasing power deposition to the gas in the glow discharge region at high pressure (100 - 250 Torr).

Several turbulence generators of various types will be introduced into flowing nitrogen and a glow discharge initiated. The discharge and flow are to be aligned. The voltage-current of characteristics, and hence power, will be recorded. Interest will of course be in those turbulence generators that result in increases in power deposition beyond that attainable without turbulence generators. Those so identified will be inserted into a flow consisting of CO2 and N2 in order to determine if the results in N2 alone are valid in a laser gas mixture.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

4.0060, MINIATURE PIEZORESISTIVE SOLID-STATE INTEGRATED PRESSURE SENSOR

S.K. KAHNG, Univ. of Oklahoma, School of Engineering, *Norman, Oklahoma* 73069 (NSG 1481)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0061, EROSIVE BURNING STUDIES OF COMPOSITE SOLID PROPELLANTS BY THE REACTING TURBULENT BOUNDARY-LAYER APPROACH

K.K. KUO, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (DF042260; AF-AFOSR-2914-76)

AF function - many current and planned future Air Force weapons systems use solid rockets as a means of propulsion. Deficiency - the current state of knowledge does not permit the accurate prediction of solid propellant burn rates under conditions of erosive gas crossflow. Objective - to determine the basic mechanism of erosive burning by formulating a theoretical model describing the important chemical and physical phenomena involved in both gaseous and solid phases and verifying the theoretical results by conducting erosive burning experiments. How work contributes - the knowledge gained from this effort will permit the design of more accurate and efficient rocket weapons systems.

Composite propellant test samples, consisting of several rectangular strips, will be fed into the combustion zone of the experiment. An optically controlled servomechanism is designed to maintain a flat burning surface. A wide range of chamber pressures, gas velocities, mass fluxes, and pressure gradients will be tested. Design of this experiment has been guided by a computer simulation of the physical processes in the driving motor and the test section. The analytical model developed will account for the effects of turbulent reacting boundary layers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0062, PRACTICAL METHODS FOR THE COMPENSATION AND CONTROL OF MULTIVARIABLE SYSTEMS

P.L. FALB, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DF046610; AF-AFOSR-3182-77)

AF function - a study of control methods for high-performance aircraft, helicopters and ballistic missiles. Deficiency - compensation and control of the above systems. Objective - the primary objective of this research effort is the development of practical methods for the compensation and control of multivariable systems. How work contributes - success in this area would facilitate the design of Air Force systems as well as their control systems.

The proposed research can be divided into three areas of consideration. First, effort will be devoted to the question of pole assignment including a consideration of the maximum number of assignable poles and to the characterization of those 'parts' of a

system which remain invariant and those 'parts' which can be freely adjusted via linear output feedback. Second, effort will be devoted to an analysis of certain 'structural' properties of multivariable systems and the influence of various forms of compensation and control upon these properties. Third, effort will be devoted to the determination of conditions under which multivariable systems can be compensated independently of plant parameter variation and perturbations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0063, MISSILE VORTEX WAKE MEASUREMENTS 14921-A-E

K.E. HARWELL, Univ. of Tennessee, School of Engineering, *Knoxville, Tennessee* 37916 (DA0F8968; DAAG29 77 G0107)

To measure the three velocity components, the turbulent intensities and the turbulent correlations in the separating boundary layer and vortex wake regions on missile bodies at high angles of attack. Relevance - the proposed investigation will provide fundamental information on the origin of forces experienced by violently maneuvering missiles and is directly relevant to the design and development of tactical missiles.

The measurements will be made in the NASA/Marshall 7-inch square subsonic/supersonic wind tunnel facility and will utilize the NASA three-dimensional laser Doppler velocimeter system. Data will be analyzed and compared with existing analytical models to provide validations and improvement.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0064, BIPROPELLANT CONTAMINATION 5 LBF

R.E. ALT, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF421010; F40600-76-C-0001)

The CONTAM computer code was developed by the AFRPL for predicting contamination from a bipropellaat thruster system and for assessing the effects of the contaminants on sensitive spacecraft surfaces. This code models the contamination production within the combustion chamber, transport with the nozzle vane, and surface property changes due to contaminant impingement and deposition. Although the code has been used in its present form for several years, it has not been verified and the obtainable accuracies have not been established. In order to assess the accuracy of the code and to determine where modifications are required, exhaust plume properties near the exit plane, exhaust specie mass deposition rates throughout the plume, and the degrading effects to the performance of various spacecraft surfaces exposed to the plume must be measured. The contaminants must be determined over wide ranges of design thrust, chamber pressure, pulsing duty cycle, valve lead-lag timing, injector types, and thruster chamber configurations in order to assess the prediction accuracy of CONTAM for varying thruster conditions.

Contamination measurements on this program will be made on a 5.0 LBF bipropellant engine. The engine will be fired in a high-altitude space simulation chamber, and the exit plane properties, plume mass deposition rates, and the effects of the plume on various spacecraft surfaces will be measured. The mass deposition rate manning will be obtained with QCMs mounted throughout the plume and with other in situ optical techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

4.0065, AGARD NAB STUDY

L.L. GALLIGHER, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF420772; F40600-75-C-0001)

Investigate various problems and test techniques associated with integrated nozzle-afterbody testing in transonic wind tunnels.

Provide a data base from which an evaluation can be made of the test techniques currently used to determine the performance of integrated airframe-propulsion systems. Based on this evaluation, new procedures can be initiated where needed to improve the wind tunnel test capability. In addition, the results of this project will provide a means of identifying influences of wind tunnel generated disturbances on test data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

4.0066, MORPHOLOGY OF DESIGN OF AEROSPACE SYSTEMS WITH INCLUSION OF HUMAN RESOURCE FACTORS

B. OSTROFSKY, Univ. of Houston, School of Engineering, *Houston, Texas* 77004 (DF046470; AF-AFOSR-3148-77)

AF function - the systems engineering/systems management procedures developed by the Air Force during the 1960's identified the philosophy and the details and implementation for Air Force systems. This documentation identified reporting details for each activity during the system life cycle and, while it left the designer free to improvise, it constrained his activities to definable and reportable categories. An improved rationale for the design of technological systems is required. Deficiency - the effects of changes or retrofits in the long-term development and acquisition of expensive, advanced technological systems must be anticipated more accurately to help eliminate significant cost overruns. Objective - the research proposed will define a decision structure required to use resources optimally in attempting to meet design objectives. How research contributes - the research resulting from this effort is intended to clarify the decision structure and methodology for the design of high-technology, large-scale Air Force systems with emphasis on integration of human resources factors and metrics.

A human factors and metric study will review recent developments in design morphology, identify relevant human factors information, clarify subjective and objective design inputs, and define areas for quantification in the evaluation of criteria. An analysis of information into a multivariate criterion function will structure an input-output matrix for each phase of an aerospace system life cycle, validate information obtained regarding criteria definition, identify aerospace system criteria conceptually, and establish the metrics for allowing assessment of the relative importance of criteria and their interactions. Clarification of methodology will define the design parameters, submodels and models of criteria, taking advantage of recent developments to structure a criterion function. Testing this function will be accomplished by using sample data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0067, WIDE-BAND FIBER OPTIC DATA TRANSFER

J.R. BAIRD, Spectronics Incorporated, *Richardson, Texas* 75080 (DF098360; F33615-74-C-1160)

To establish the status of state-of-the-art components and techniques for point-to-point wide-band data transmission using fiber optic technology.

The contractor will be responsible for the design, development, fabrication, demonstration, and evaluation of a point-to-point, wide-band, (greater than 100 mHz) fiber optic data link, capable of transmitting and receiving analog and baseband digital information. Signal formats, typical of AF high data rate equipment, will be used in conjunction with the total evaluation of the system. The link will be deliverable and will be used in-house for further testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0068, SEMICONDUCTOR LASER DEFECTS

B. THOMAS, Univ. of Wales, Inst. of Science & Technology, *Cardiff, Wales, United Kingdom* (DF902680; AF-AFOSR-3206-77)

AF function - airborne and ground communications. Deficiency/opportunity - existing wire systems deficient in terms of bandwidth, security susceptibility, electrical interference. Objective -investigate switching characteristics of light sources for fibers. How research contributes - establish limitations on pulse operation of various laser diodes.

Fast rise time pulse measurements will be undertaken on various laser structures. Delay, 'q' switching, etc, will be in-

vestigated and in certain instances deliberately induced through material defects from neutron irradiation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0069, PULSE PROPAGATION AND SCATTERING IN RANDOM MEDIA
A. ISHIMARU, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (ENG77-12544)

This program is concerned with propagation and scattering characteristics of a short pulse in a random medium and the effect of transmission medium inhomogeneities on wave fluctuations. The study will concentrate on the following specific topics: (a) Pulse scattering from a dense random medium and image resolution. This includes studies on coherence time, coherence bandwidth, the effects of particle size and velocity distributions, backscattering and bistatic scattering from turbulence and particles, range and lateral resolutions and the effect of the imaging system. (b) Effects of inhomogeneities. This involves study of the effect of ray-bending and shrinkage of the Fresnel size on wave fluctuation characteristics, and extension of the analysis to the strong fluctuation case and to thin screen theory. The above studies will be conducted with a view towards optical, acoustic and microwave applications in communications, remote-sensing, detection, and imaging problems. Some ultrasound and optical experiments will be conducted to verify theoretical predictions.

This is a continuation of research previously supported under NSF grant ENG-7423540.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, STANDARDIZED FOREST CONDITION CLASSES FOR AERIAL FOREST INVENTORY
E.W. JOHNSON, Auburn University, Agric. Experiment Station, *Auburn, Alabama* 36830 (0005688; ALA00909)

OBJECTIVE: Establish a set of standard forest condition classes which can be identified on standard U.S.D.A. aerial photographs and determine the rate of error of identification of these classes when the identification is made by typical forest management personnel. Determine whether the composition of these classes is sufficiently consistent that standard stand tables can be used, along with light on-the-ground checks, to obtain reliable volume estimates.

APPROACH: An array of forest cover condition classes will be defined in terms of species composition, tree size, and stand density. A dichotomous identification key will be developed to permit classification of forest stands imaged on conventional USDA aerial photography. The ability of typical foresters to use the system and the key will be tested. This will be done by physiographic regions within the state. If the rate of error is 10% or less, plots (both fixed radius and prism) will be established in the classes and data obtained for the construction of stand and stock tables.

PROGRESS: The key for the Ridge and Valley Regions is in manuscript. The field work for the Cumberland Plateau Region is essentially complete but only a few preliminary analyses have been made. The field work for the Highland River and Warrior Basin Regions is in progress.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Alabama

5.0002, MULTIBAND SPECTRAL RECONNAISSANCE FOR FORESTRY
R.N. COLWELL, Univ. of California, Agric. Experiment Station, *Berkeley, California* 94720 (0023154; CA-F0-FRU-2180-MS)

OBJECTIVE: Purpose of the research include determination of the accuracy and ease with which various forest characteristics can be identified and/or measured by various remotely situated electro-magnetic sensors; the applicability of infrared, ultraviolet and radar imagery to collection of forest fire and hydrologic information; and the techniques needed for effective application of these devices to various problems of forest, range, and wildland reconnaissance.

APPROACH: Test areas will be selected and accurately mapped in order to locate all physical features to be studied; simultaneous multi-band spectral reconnaissance for each test area will be obtained; on the basis of ground evaluation of this reconnaissance, specifications and keys will be developed to define operationally effective uses of the technique.

PROGRESS: The value of multiband spectral reconnaissance as an aid to the mapping of fuels and the management of brushlands and timberlands in Mendocino County, California. Working with various land use experts in that county we have completed a photo stratification of fuel types in a representative test site using multiband space photography (green, red and near-infrared wavelength bands as acquired from NASA's Landsat spacecraft from an altitude of 570 miles) augmented by Infrared Ektachrome 'high flight' photography taken from an altitude of 65,000 feet by a U-2 aircraft. It is planned, based on this work, to conduct at least one control burn and also one mechanical brush-removal operation within this test area in the spring of 1977.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, California

5.0003, INVERSION THEORY RESEARCH
W. KAULA, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DF243250; F19628-75-C-0007)

AF function - weapons systems navigation and delivery. Deficiency - geoid uncertainties degrade accuracy of weapons delivery. Objective -use of inversion theory to determine terrestrial gravity field. How research contributes - will provide a firm basis for evaluating the gravity field from satellite data.

The contractor will rigorously explore the accuracy potential of inversion theory as it pertains to the determination of the terrestrial gravity field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0004, DESIGN AND FABRICATION OF A MAGNETIC DATA COLLECTION SYSTEM
R.L. MCPHERRON, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DF278550; F19628-76-C-0043)

AF function - systems for communications, guidance, navigation and detection. Deficiency - performance degrades and becomes unpredictable during severe magnetic activity. Objective - improvement and expansion of the data collection network for use in the specification and prediction of magnetic activity. How research contributes - the ability to predict magnetic activity would enable NORAD to anticipate critical periods for their systems and to exercise options for alternate methods and would minimize SAC missions that are aborted by communications problems through rescheduling or transmission mode changes.

The performance of network hardware now in use for collecting geomagnetic activity data will be reviewed and design changes made as required. Three additional fluxgate magnetometers, three digital data collection packages and a digital data acquisition station package will be constructed to the new designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0005, SOLAR MAGNETIC FIELDS
R.C. SMITHSON, Lockheed Missiles & Space Co., *Palo Alto, California* 94304 (DF248970; F19628-77-C-0128)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions. Objective - determine the effect of motions and magnetic fields on the solar atmosphere and how each contributes to the environment for solar activity. How research contributes - pro-

vides the physical knowledge necessary for a sound cause-and-effect prediction technique for solar induced disruptions.

Observations will be made to establish the size and strength of magnetic elements and to determine spatial correlations between the magnetic and velocity fields in the atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0006, CALIBRATING LANDSAT DIGITAL DATA TO FIT MAP BASES WITHIN THE NATIONAL PETROLEUM RESERVE - ALASKA

D.E. SCHWARTZ, Calif. State Univ. & Colleges, School of Social Science, *San Jose, California* 95114 (NCA 2-675802)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0007, OPTICAL PROCESSING OF AERIAL PHOTO PATTERNS IN PHASED LIGHT

M.G. TANGUAY, Univ. of Montreal, Polytechnic School, *Laval, Quebec, Canada* (164468 (HRB NO.))

The purpose of the project is the analysis by optical filtering of aerial photos of typical geological structures. Positive results have been obtained. The program is being pursued by the acquisition of a more versatile instrumentation which could accelerate the filtering process. A series of ERTS images are also to be analyzed.

SUPPORTED BY Supporting Organization Not Reported

5.0008, AMBIENT AIR QUALITY SURVEY

K. ZELLER, U.S. Environ. Protection Agcy., *Washington, District of Columbia* 20460 (DF407440)

To measure air quality levels near selected Air Force bases under a wide variety of meteorological conditions. Measurements will be used to (1) determine the local impact and compliance with federal ambient air quality standards, and (2) to define accuracy limits for the computerized USAF/Argonne National Laboratory air quality assessment model (AQAM).

Study will be joint USAF/EPA/USN/FAA/ERDA project, with EPA providing principal investigator. Phase I includes studies to determine optimum sampling locations, and a background investigation of atmospheric chemistry analytical techniques and of data acquisition and evaluation systems and techniques. Phase II includes performing ambient air quality measurements at Williams AFB, Arizona, utilizing five continuous monitoring stations. One complete year of acceptable data will be obtained. A second year of data collection is planned for a large naval air station. Measured data will then be compared with theoretical data predicted by the AQAM in project 19005A18.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Civil & Environmental Engineering Development Office

5.0009, ELECTROOPTICS METEOROLOGY (METEOROLOGICAL SUPPORT SYSTEMS)

H.E. GERBER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN639124)

Improve the operational capability of the Navy in its function of assessing the state of the marine boundary layer to support such strategic and tactical systems which are vulnerable in their performance to clouds, aerosol, water vapor and turbulence. Provide instruments and methods to establish useful climatologies, to give real-time support and to develop forecast capabilities on electrooptics transmission parameters.

Exploratory instrument development is applied to further the understanding of the relationship between marine aerosol and meteorological parameters and the electrooptics transmission parameters which are required for optimizing the utilization of specific Navy EO systems. The present effort includes the exploratory development of a portable transmission trends in a fog environment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0010, ATMOSPHERIC PHYSICS (ATMOSPHERIC ELECTRICITY AND CLOUD PHYSICS)

W.A. HOPPEL, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN480215)

Provide new and improved capabilities to the Navy in overcoming operational difficulties caused by hazardous environmental conditions and in using the environment to an advantage. Acheive a better understanding of cloud and fog dynamics, nucleation, glaciation, condensation, atmospheric electrification, pollution, and atmospheric radioactivity.

Perform interrelated laboratory, field, and modeling experiments and develop the theoretical tools necessary to explain and predict the observed results. Field experiments include the use of aircraft, ships, and ground field sites as platforms for data acquisition. The data acquired from laboratory and field investigations are analyzed and compared to the predictions of current theoretical models with the aim of improving these models and our understanding of atmospheric physics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0011, NAVY ENVIRONMENT - REMOTE SENSING OF COASTAL WATERS

O.K. HUH, Louisiana State Univ. Systems, Coastal Studies Institute, *Baton Rouge, Louisiana* 70803 (DN575159; N00014-75-C-0192)

This research will be directed toward an investigation of the effects of an intrusion of a new air mass into a coastal or continental shelf region. An intrusion is accompanied by wind shifts and temperature changes which produce significant changes in the ambient wave, current, and near-surface temperature fields. These environmental changes will materially affect the conduct of a variety of Navy/Marine Corps operations in coastal waters.

A series of field investigations will be undertaken near Panama City, Florida, at times coincident with intrusions of polar ice masses into the north-central Gulf of Mexico. Oceanographic, meteorologic, and radiation measurements will be made to determine the temperature gradients (horizontal and vertical), heat fluxes, and transformation (changes in heat content, salinity, and density) of coastal waters. Cold front passages will be categorized according to type, intensity, duration, and geographic extent, and their effects on coastal waters. All data will be correlated in order to specify, and possibly predict, infrared imaging capabilities during cold front passages.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0012, ANALYSIS OF HIGH-ENERGY X-RAY SPECTROMETER DATA

A. ROSENFELD, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (NCA 5-79)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0013, ELECTRON AND ION BEAM SYSTEMS

H.A. COHEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249270)

AF function - communication satellites in geosynchronous orbit. Deficiency - electrical charging of satellites by ambient particles causing anomalous switching in electronic circuitry. Objective -development, testing and use of charge ejection systems to duplicate, prevent, or control satellite charging. How research contributes - by the development, testing and use on space vehicles of charge ejection systems, charging of satellite surfaces can be controlled for predetermined periods, obtaining either large or small potential differences with respect to ambient plasma.

A satellite electron beam system (SEBS) and a satellite positive ion beam system (SPIBS), are being developed, built, and tested, using a combination of contractual efforts, and in-house AFGL laboratory work. These efforts are being coordinated with those responsible for SCATHA to obtain instruments with the optimum specifications in terms of the required measurements and the satellite's physical and electrical requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, ULTRAVIOLET RADIATION

L.A. HALL, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244820)

AF function - environmental impact of high-altitude vehicles. Deficiency - effect of aircraft effluents on solar UV absorption and on ozone. Objective - to determine solar, ultraviolet energy deposition rates and ozone concentrations. How research contributes - energy deposition rates and ozone concentrations will improve models used in computation of environmental impact of air force vehicles.

Balloon flights of a solar spectrometer will provide data on the solar spectrum in the range 2000-3000A, as a function of height in the stratosphere. From these data, energy deposition rates and ozone concentrations will be computed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, IONOSPHERIC TIME DELAY STUDIES

J.A. KLOBUCHAR, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249130)

AF function - this development work will improve satellite detection radar accuracy and space based radio navigation system accuracy. Deficiency or opportunity - present and future satellite ranging systems are limited in accuracy in some modes of operation by ionospheric and plasmaspheric time delays. Objective - the correlation of ionospheric time delay for signals received at pairs of stations, and in different directions from the same station, will be determined using existing ionospheric total electron content (TEC) data. Additionally, the contribution of the plasmaspheric electron content data to total time delay in the equatorial region will be determined using data from Huancayo, currently available. How research contributes - existing models and methods of updating ionospheric corrections to radio ranging systems will be improved by a knowledge of the spatial correlation of TEC measurements. The heretofore unknown contribution of the plasmaspheric time delay will be modelled and will be used as a correction term to existing time delay representations.

Mean daytime and nighttime values of ionospheric TEC will be used to make statistical comparisons of pairs of measurements taken at the same station looking in different directions, and also at widely separated stations. The plasmaspheric time delay, which is the difference between the true group path delay and that determined from the Faraday effect, will be determined using presently available data from a station at Huancayo, Peru, and will be used to correct existing time delay models, which are based upon Faraday data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, SATELLITE DENSITY MEASUREMENTS USING IONIZATION GAUGES AND LASER SOUNDING

J.P. MCISAAC, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249440)

AF function - low-altitude operational satellites, airborne surveillance, ballistic nuclear weapon delivery. Deficiency -inaccuracies in the determination of low-altitude satellite ephemerides due to inadequate data on density variations at critical altitudes. Objective - acquisition of atmospheric density measurements on a global scale. To define, correlate and/or empirically relate results with solar and geophysical phenomena. How research contributes - permits direct accurate measurements of density used in the development and upgrading of forecasting techniques.

Inflight measurements of atmospheric density will be performed onboard the S77-2 spacecraft. Along with direct measurements with improved ionization gauge instrumentation, a newly developed particle flux accumulator sensor (PFA) has been developed and will be flight tested on the S77-2 flight. This instrument has the capability of measuring vehicle attack angle and atmospheric temperature in addition to density. Data acquisition from the S3-2 satellite continues and reduction techniques have been initiated. Analysis programs for use with the S3-1 data base are being developed which will allow correlative and interpretive studies to be performed, permitting a more comprehensive evaluation of model deficiencies. As more measurements from future spacecraft flights are accumulated, this data base will be supplemented with results obtained during the maximum phase of the solar cycle. Remote sounding techniques utilizing laser technology are being developed for satellite density measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, USE OF DIGITAL RADAR IN SHORT RANGE FORECASTING

S.H. MUENCH, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF243920)

AF function - local airfield and missile base operations. Opportunity - provide more accurate and timely weather warnings by using digital data processing. Objective - the goal is to develop fast, accurate forecast procedures based on digital radar output. How research contributes - successful techniques developed will be adopted by Air Weather Service and utilized in forecasts of severe weather to enable preventative action to safeguard personnel and equipment.

At the mesoscale forecast facility of AFCRL, a standard FPS 77 radar has been linked to a dedicated computer. Digital radar data collected during intense storms will be processed to make comparisons with data from Mesonet stations, and establish relationships to rainfall rate, wind velocity, and visibility. These relationships will be incorporated in an automatic extrapolation forecast system and tested as an objective aid or a 'stand alone' forecast system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, ANALYSIS AND CATEGORIZATION OF ENERGETIC SOLAR PARTICLE EVENTS

M.A. SHEA, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248910)

AF function - survivability, solar effects on satellite and missile operations, detection, surveillance, and communications. Deficiency -inability to satisfactorily describe and accurately predict solar and precipitating particle events which affect the aerospace environment in which USAF systems operate. Objective - survey the energetic particle environment that USAF spacecraft and systems experience during operation throughout a solar cycle. To determine the critical factors that control this environment. To identify the potential parameters that are predictors of this environment, and to evaluate and update solar proton prediction techniques. How research contributes - an understanding of the particle population in the environment in which USAF systems operate, and changes thereto, will be obtained with respect to solar cycle variations. The analysis of the particle data, together with correlative and related solar-terrestrial environmental data will be utilized to improve the prediction of critical environmental parameters. This will give increased accuracy and reliability in anticipating system performance and survivability during environmental conditions that can exist during a solar cycle.

Energetic particles accelerated at the sun propagate, through the interplanetary medium and the magnetosphere, impinge on the atmosphere and space vehicles, and significantly affect the E.M. propagation via the ionosphere. Energetic solar particle data acquired by both satellite and ground-based sensors for the past two solar cycles will be acquired and categorized in an effort to delineate the behavior of the particle flux at various times of the solar cycle and under different solar-terrestrial environmental conditions. Analyses will be conducted utilizing these data together with the interplanetary magnetic field and solar wind data with the objective of improving the presently utilized methods for predicting the aerospace environment and consequently the reliability and quality of performance of USAF systems that operate in this environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, ATMOSPHERIC MODELING AND RADIATIVE TRANSFER STUDIES
E. SHETTLE, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244310)

AF function - reconnaissance, communications, surveillance, guidance, target acquisition and tracking. Deficiency - the performance of any optical system looking through the atmosphere is significantly degraded by atmospheric light scattering and absorption and it, therefore, depends in a complex way on the variability of the state of the atmosphere in the theater of operation. Objective - development of models of the pertinent atmospheric optical parameters representative of various environmental conditions, and conduct theoretical investigations of the effect of the atmosphere on optical signals passing through it, using these models. How research contributes - the atmospheric models and radiative transfer computer codes developed under this work unit allow calculating the atmospheric effects on any optical or infrared system. Knowledge of these effects is basic input to the design or evaluation of the operational performance of such a system. Examples of the atmospheric effects on EO/IR systems are - the degradation of image contrast due to atmospheric scattering, absorption and emission (reconnaissance and surveillance systems, contrast-type weapons-guidance systems) - the atmospheric attenuation of laser designators and weapons systems - or off-axis detection of laser signals because of atmospheric scattering.

Problems being studied are how the optical properties of the atmosphere vary with geographical location, height in the atmosphere, season and long-term changes in the atmosphere, using measurements made under other tasks of this project. The theoretical studies are oriented towards the development of more flexible and computationally more efficient methods for radiative transfer calculations, giving particular consideration to the multiple scattering effects of aerosols and air molecules. These computational methods are then applied to the prediction and calculation of such quantities as contrast transmission, or background of scattered sunlight which are required as inputs for the solution of specific Air Force problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, IN-SITU MEASUREMENTS OF FIELD-ALIGNED CURRENT SYSTEMS
R.P. VANCOUR, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF257190)

AF function - communications in and through the ionsophere, surveillance, and detection. Deficiency - inability to cope with interference to these functions caused by magnetic storms and substorms. Objective - to obtain knowledge of the sources and mechanisms responsible for intense geomagnetic activity in order to develop polar substorm models which are needed for a prediction capability of the occurrence, intensity, and duration of such activity. Specifically, to investigate magnetic field-aligned currents, ionospheric currents, and electron characteristics in the ionosphere and magnetosphere over the auroral regions during polar substorms. How research contributes -analysis and interpretation of data will provide information to develop concepts needed to improve polar substorm models.

Data from two experiments which measure vector magnetic fields and energetic electron fluxes on the polar orbiting satellite S3-2 are being reduced and analyzed to determine the position and intensity of field-aligned currents and the spectral distribution of the current carriers during magnetically disturbed periods and ambient quiet conditions. These results will be compared with other satellite data and ground station data to provide a comprehensive definition of magnetic substorm electrodynamics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, CONDUCT RESEARCH TO DESIGN, DEVELOP AND CONSTRUCT ENERGETIC PARTICLE DETECTION INSTRUMENTATION FOR SPACE FLIGHT
M.P. HAGAN, Emmanuel College, Graduate School, *Boston, Massachusetts* 02115 (DF266620; F19628-76-C-0039)

AF function - communications and surveillance. Deficiency - inability to predict solar particle effects on atmospheric and ionospheric environmental conditions. Objective - this is a research effort directed toward the design, development and construction of energetic particle detection instrumentation for satellite flight. Design instruments to measure energetic particle fluxes, discriminate species (electrons, protons and/or ions), and perform energy analysis. Instrumentation must be capable of discovering new scientific knowledge concerning the near-earth space energetic particle environment and be compatible with available Air Force satellite rides. The effort will cover the whole spectrum from design through construction and integration into the host satellite vehicle. Some adjustments in design may be required during integration to account for design discrepancies in the host vehicle. This re-design may have to be performed on extremely tight time schedules and, hence, personnel will have to be present during integration. How research contributes - provides instrumentation for detection and identification of energetic particles in space.

State-of-the-art instrumentation is developed and matched to available satellite rides with limited notice as to required sensitivities, data rates and limited power allotments. Instrumentation must be adapted to current research needs based on past experience and available components. New devices such as position sensitive detectors, micro-processors and magnetic materials must be integrated into current designs to obtain maximum spatial, angular and energy resolution consistent with reliability and delivery schedules. Instrumentation must be integrated into satellite payloads and adjustments and repairs made as required. Reports on all aspects of the instrumentation and data formats are prepared for utilization and interpretation in analysis of final data. Personnel remain available up to final launch for recalibration and repairs and assist in evaluation of data during launch and post-launch period. Final calibration is conducted following launch during the data reduction process. Passive detectors recovered from space flights are studied for intensity and identification of species, i.e., protons or electrons.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, TOTAL ELECTRON CONTENT AND SCINTILLATION STUDIES
P.M. HAGAN, Emmanuel College, Graduate School, *Boston, Massachusetts* 02115 (DF245980; F19628-76-C-0003)

AF function - communications and navigation. Deficiency - radio fading and timing errors. Objective - improve performance of communication and navigation systems. How research contributes - provide data for statistical models of propagation effects.

Paper chart and magnetic tape record will be analyzed to determine parameters which relate the variations in total electron content and amplitude scintillations to the degradation in performance of navigation and communication systems. The data base will include sites ranging from the auroral zone to the equatorial region and allow for the development of global models depicting the variations in TEC and scintillations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, MARTIAN DUST STORMS
R.M. GOODY, Harvard University, School of Engineering, *Cambridge, Massachusetts* 02138 (NSG 7398)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0024, TROUGH WALL MODEL STUDIES
T.B. BARRETT, Parke Mathematical Labs. Inc., *Carlisle, Massachusetts* 01741 (DF248200; F19628-76-C-0296)

AF function - communications and detection. Deficiency - sufficiently accurate corrections for range/azimuth errors of OTH radar systems due to propagation in the high-latitude ionosphere. Prediction and real time specification of disturbances in auroral

and equatorial ionosphere. Objective - to study the errors in OTH radar range and azimuth measurements introduced by changes in the structure of the f-layer trough wall. To study effects of the known variability of the trough wall. To investigate signal characteristics as spectral components and amplitude probability distribution for VHF/UHF satellite signals received under equatorial/arctic scintillation conditions. How research contributes - improvements of OTH radar test and operating procedures based on theoretical error predictions. Improvements of satellite communications systems in terms of improved technical specifications and operating procedures.

For specific combinations of radar frequencies and antenna parameters, 3-dimensional ray tracing will be used to determine the deviation in azimuth and the changes in expected range and energy density of the beam in the landing area caused by the electron density gradient in the ionospheric trough wall. Computations will be made using a median gradient model of the poleward mid-latitude trough wall, and also using variations in electron density of trough and variations in gradient values of the trough wall. Computer programs will be adapted to allow processing of airborne scintillation data to obtain power spectra, amplitude probability distributions and scintillation indices. An attempt will be made to correlate the structure of equatorial and auroral irregularities with airborne scintillation observations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, GEOMONITOR DISPLAY SYSTEM
J. BUCHAU, Digicom Incorporated, *Chelmsford, Massachusetts* 01824 (DF247830; F19628-76-C-0307)

AF function - ionospheric monitoring in support of communications, radar, and navigation systems. Deficiency - acquisition costs of geophysical data from remote, arctic locations are high, limiting amount and quality of data available. Delays in reporting auroral and geomagnetic disturbances have to be avoided for real time support of AF Global Weather Central. Objective - development of techniques for the transmission and display of real-time high-latitude ionospheric and other geophysical data at Air Force user locations in forms useful for monitoring the auroral and ionospheric substorms. How research contributes - makes high-latitude ionospheric and geophysical data, needed for planned ionospheric models, available at AF system user sites.

Procure prototype system to generate ionospheric characteristics and reconstituted ionograms from data messages and to provide hard copy printout of the ionospheric characteristics and other geophysical parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, CODE SENSITIVITY STUDIES FOR PHOTODETACHMENT AND PHOTODISSOCIATION
G.T. BEST, Univ. of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DF248450; F19628-76-C-0295)

AF function - nuclear weapons effects, nuclear weapons delivery, intercept weapon delivery. Deficiency - radar and communications blackout following nuclear detonations cannot be accurately predicted. Objective - to determine the sensitivity of the AFGL/Keneshea photochemistry computer code to variation of the rates of photodissociation and photodetachment for important atmospheric negative ions. How research contributes - provides information on the overall importance and accuracy required for photodissociation and photodetachment processes in predicting the temporal and spatial extent of blackout from natural and nuclear perturbations of the atmosphere.

A survey will be made of available information on the identity of and the rates of photodetachment and photodissociation for important negative ions in the atmosphere. Study will then be made of the effects of photodetachment and photodissociation upon atmospheric ion composition and electron density as determined by varying the rates for these processes as input parameters in the AFGL/Keneshea photochemistry computer code. The variation of free electron densities predicted by the code will then be correlated with existing ionosonde measurements following magnetic storms and pronounced auroral activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, INSTRUMENTATION ANALYSIS DESIGN AND FABRICATION OF SYSTEMS FOR AIR FORCE PROGRAMS
A.H. HOWELL, Tufts University, School of Engineering, *Medford, Massachusetts* 02155 (DF248700; F19628-77-C-0047)

AF function - scientific balloon systems and associated instrumentation. Deficiency or opportunity - exploit the performance capabilities of free and tethered balloons by designing systems for highly specialized scientific payloads or for unusual flight performance requirements. Objective - to provide expert analysis and design, and limited fabrication of instrumentation and balloon system components for special applications. How research contributes - appropriately designed, instrumented balloon systems provide efficient and often uniquely useful high-altitude and tethered platforms for emergency communications, surveillance and optical observations.

Balloon/payload configurations such as the balloon altitude mosaic system (BAMM), the air-launched balloon system (ALBS) and the LORAN C balloon-borne antenna system will be analyzed and component design changes initiated if needed to ensure optimum balloon/payload performance. The problem of lightning protection will be studied and lightning protection devices will be designed for tethered balloon systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, MULTI-SENSOR GRAVITY DATA BASE
R.F. BRAMMER, Analytic Sciences Corporation, *Reading, Massachusetts* 01867 (DF249680; F19628-77-C-0235)

AF function - weapon systems navigation, guidance and delivery. Deficiency - launch site, target position and geoid uncertainties degrade accuracy of weapon delivery. Objective - automated procedures for integration of multi-sensor gravity data. How research contributes -contractor will develop an automated technique for gravity data integration.

A multi-data, multi-processing approach will be explored. Emphasis will be placed on producing gravity data most suitable to users' requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, APPLICATION OF EARTH'S ALBEDO MEASUREMENTS TO CLIMATE STUDIES
F.L. BARTMAN, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (NSG 1482)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0030, METHODOLOGY FOR DETERMINING STRATOSPHERIC-TROPOSPHERIC MASS EXCHANGE
UNKNOWN, Oregon State Higher Educ. Sys., Graduate School, *Corvallis, Oregon* 97331 (FA77WA-3992; FA160416 (TRAIS NO.))

Develop, test and document an objective methodology for the quantitative determination of the amount of air exchanged between the stratosphere and the troposphere. Such determination shall include the mean values and the variabilities of the mass exchange rates as functions of altitude, latitude, longitude, season and year.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

5.0031, RANGELAND RESOURCE EVALUATION FROM LANDSAT
J.C. HARLAN, Texas A & M University System, Graduate School, *College Station, Texas* 77843 (NAS 9-15465)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0032, INVESTIGATION OF THE INTERSTELLAR MEDIUM
C.A. HARVEL, Houston Baptist University, Undergraduate School, *Houston, Texas* 77036 (NSG 9064)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0033, NAVY ENVIRONMENT - CLOUD ELECTRIFICATION
D.R. TOMPKINS, Terrene Corporation, *Refugio, Texas* 78377 (DN223331; N00014-76-C-0404)

In the interest of developing wider weather options for the deployment of electrooptic systems, the objective of this research is to remotely sense the stage of electrification of a cumulus or a thundercloud.

The technique of measurement depends on detection of the radio emission from the cloud that results from the electric field of the cloud moving charge deposited from small cosmic-ray showers.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0034, MEASURE NITRIC OXIDE IN THE STRATOSPHERE
A.W. SHAW, Utah Higher Education System, Center for Res. in Aeronomy, *Logan, Utah* 84321 (ATM75-09206 A02)

This grant funds the development and use of a sensor to measure the nitric oxide concentration on both balloons and rockets. Such a sensor is thus capable of determining both the temporal variability (on a balloon) and the altitude profile (on a rocket). This is done using a chemiluminescent technique, in which the nitric oxide in the air is reacted with ozone carried as part of the sensor, and the resulting light emission is then measured with a photometer. A much larger version of this detector has been flown successfully on balloons; part of the effort here involves miniaturization. Following the development, measurements will be made using the sensor on several balloons and rockets. This supplement allows the initial objectives to be pursued by replacing an essential piece of equipment (dropsonde) that was stolen before recovery after being released from a high-altitude balloon.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0035, SPECTRAL AUTOCORRELATION FOR FEATURE EXTRACTION FROM AERIAL PHOTOGRAPHY
R.D. LEIGHTY, U.S. Army, Engineer Topographic Labs., *Fort Belvoir, Virginia* 22060 (DA0M8065)

The autocorrelation function of the spatial frequency spectrum will be investigated for potential application to automated feature extraction from aerial photography. It is anticipated that the study will show that this function can be used in automated feature extraction as is the optical power spectrum, but without detrimental phase effects due to emulsion thickness variations and base inhomogeneties. A useful application would be in the topographic field.

The optical power spectrum analysis approach to feature extraction and image quality prediction can have its results corrupted by emulsion relief and base materials. This analytical and experimental research study will develop the concept and applicability of spectral autocorrelation to remove these limitations.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

5.0036, AUTOMATED FEATURE EXTRACTION TECHNIQUES AND STRATEGIES RESEARCH
G.E. LUKES, U.S. Army, Coherent Optics Center, *Fort Belvoir, Virginia* 22060 (DA0N8004)

To conduct research in automated pattern recognition and analysis strategies leading to the development of techniques and systems for automated feature extraction from aerial imagery for application to automated cartography and MGI.

Research will investigate optical and digital and hybrid automated pattern recognition techniques which lend themselves to incorporation or total replacement of manual or interactive capabilities for the recognition of natural and cultural features from aerial imagery. Techniques will be developed for characterization of aerial imagery and data from terrain data bases. Particular attention will be given to those algorithms and strategies for definition of concepts of automated feature extraction systems of the future. Techniques will attempt to integrate data from different data domains, i.e., space domain, sensor domain, spatial frequency domain, terrain elevations, data base information, etc. Analysis strategies will define the sequential decision processes associated with recognition and delineation.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

5.0037, STUDIES OF EXTRATROPICAL CYCLONIC STORMS
P.V. HOBBS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DF047280; F49620-77-C-0057)

AF function - the ABRES program as well as design climatology at AFGL requires continued cloud physics measurements. The AWS requires mesoscale modelling to parameterize energy and water balance in numerical weather prediction. Deficiency - rainfall statistics, cirrus parameters, mesoscale energetics and dynamics. Objective - to observe and understand the processes in extratropical cyclonic storms and extract the dynamics, cloud physics and energetics of their evolution. Contribution - provides aerospace system design criteria information, specifies dynamics and energy processes for mesoscale modelling.

This research will use aircraft, radar, rain guage network and satellite date to investigate cyclones impacting the coast of Washington.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0038, CONSTANT LEVEL BALLOON-SATELLITE MONITORING PROGRAM FOR THE STRATOSPHERE
V.E. SUOMI, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (NSG 7390)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0039, STRATOSPHERIC CONSTITUENTS
D.J. HOFMANN, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (DN223089; N00014-76-C-0170)

The objective of this research is to assess the contributions of aircraft and other sources to the present condensation nuclei (CN) concentration in the atmosphere. The research will also attempt to determine transport mechanisms in addition to recognizing sources and sinks of CN.

This research involves sampling environmental parameters such as CN and other particulate matter from balloon platforms in the vicinity of Laramie, Wyoming. Also involved is data reduction and analysis to determine the non-volatile components of CN since aircraft emissions of carbon (non-volatile) contribute to the large amounts of CN present in the troposphere (surface to 30K ft). It is suspected the same conditions could affect the stratosphere (30K - 160K ft).

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, EVALUATING THE TRAINING EFFECTIVENESS OF THE SIMULATOR FOR AIR-TO-AIR COMBAT (SAAC)
L.D. POHLMANN, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF221130)

To provide assistance as required to TAC and TAWC in: (a) developing the plan for conduct of the OT&E with particular emphasis on experimental design performance measurement and data collection and analysis techniques, (b) conduct of the OT&E, and (c) analysis, interpretation and reporting of the project results.

A program directive was published by TAC which provided a consolidated statement of OT&E objectives. These requirements will provide a basis for development of the OT&E plan. Phase I will be directed at insuring the simulator performs as required, definition of the instructional capabilities provided and development of a syllabus for use in phase II. Phase II of the OT&E will involve conduct of F4-E student ACM training in the SAAC and evaluation of the effectiveness of that training by comparison of performances in aircraft. The experimental design will encompass accepted procedures modified as necessary to satisfy specific TAC requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, AUTOMATED MEASUREMENT FORMATION FLIGHT TRAINER
G.B. REID, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223270)

To develop and evaluate a performance measurement system to automate data collection in the formation flight trainer (FFT). The resulting software and data base will be broad enough to be used in constructing a measurement system for formation flight in the advanced simulator in pilot training (ASPT).

A measurement system will be developed that will model instructor pilot (IP) evaluation. This will be accomplished by testing the ability of both students and IPs to fly the FFT. During these data runs, performance will be recorded by the automatic data acquisition and control system (ADACS) and two IP evaluators will independently rate performance. The IP data and the combined data base will be used to develop a prediction equation using the IP evaluator grades as a criterion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, EVALUATION OF T-37 IFS SYLLABUS IN THE ASUPT
D.C. WEYER, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222870)

To evaluate proposed syllabi for the T-37 IFS eliminating all instrument category training in the aircraft (with the exception of the instrument checkride), to develop training features, to determine requirements for console operator training, and to establish time-sharing procedures for the terrain model board. The subjects in the project will also be used in the validation of the ASUPT performance measurement system.

Four UPT students will be subjects. They will receive simulator training using the ASUPT in the basic, instrument and navigation categories of T-37 training. Evaluation in the basic category training will be a comparison of task frequency to proficiency in the aircraft as compared to a group undergoing normal training. Evaluation of the instrument/navigation category training will be comparison of instrument checkride scores with scores of students undergoing normal training. If, as a result of this study, significant revisions should be made to the syllabus, a second study will be performed to evaluate the revised syllabus.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, ADAPTIVE PROCEDURE FOR MEASUREMENT OF FLYING TRAINING PROFICIENCY - PHASE VI
B. LESHOWITZ, Arizona State University, School of Liberal Arts, *Tempe, Arizona* 85281 (DF037260; AF-AFOSR-2555-73)

AF function - this is an effort directed toward the development of an automated metric for assessing pilot performance in real and simulated aircraft. Deficiency - while progress has been made in flying training assessment, there is still a range of difference in judgment of specific behavior and in summations of overall performance. Objective -the proposed research will examine the extent to which performance on a relatively inexpensive, low-fidelity part-task simulator assists subsequent performance on related aspects of the undergraduate pilot training program. How research contributes - data would lend evidence to the feasibility of a low-cost instrument trainer. Specifically, the research will provide automatic measures of student performance during aircraft maneuvers which comprise the UPT curriculum. The research will make available computer software for programming the flight instruments, maintaining model profiles of each maneuver, a record of student performance relative to the model, and error scores to the instructor and his student.

Several experiments will examine acquisition and transfer of flying training performance on the part-task simulator. The potential of integrating computer-aided instruction will be explored. Continued refinement of the proficiency metric is planned, with special emphasis placed on its extension to the initial stages of flying training.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0005, SYSTEM ANALYSIS OF PHYSIOLOGICAL PERFORMANCE RELATED TO STRESSES SUCH AS THOSE EXPERIENCED IN HIGH-PERFORMANCE AIRCRAFT
R.F. WALTERS, Univ. of California, School of Medicine, *Davis, California* 95616 (DF046770; AF-AFOSR-3153-77)

AF function - Air Force operations expose personnel to a wide range of environmental stresses. Varying levels of performance degradation occur as a result of such exposure. Deficiency - ways are needed to predict physiological and performance decrements under the various combinations of stress situations encountered in Air Force operations. Standards of fitness are required. Objective - this research should provide data for validating conditioning regimens leading to satisfactory levels of tolerance and to screening and predictive models for use in selecting and monitoring personnel.

Exercise protocols and non-invasive techniques will be utilized. Modeling and analyses of human organ systems will be accomplished. How research contributes - the research supports USAFSAM and AMRL studies dealing with protective equipment and setting design criteria for crew habitability and selection, and is identified under subareas 1.5, 1.6, and 1.7.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0006, LIGHT AND ELECTRON MICROSCOPIC INVESTIGATIONS OF THE CONNECTIONS OF BRAIN STEM EMETIC TRIGGER ZONE REGIONS
R.L. SNYDER, Univ. of California, Graduate School, *San Francisco, California* 94122 (NCA 2-665802)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0007, A HEART RATE INDEX FOR PREDICTING ENERGY ALLOCATIONS
G.F. LUND, Calif. State Univ. & Colleges, Graduate School, *San Jose, California* 95114 (NSG 2293)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0008, STUDIES ON THE EFFECTS OF DIFFERENT CONCENTRATIONS OF CALCIUM AND OTHER IONS ON TISSUE METABOLISM IN TEMPERATURE REGULATION
R.H. ROCHELLE, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (NCA 2-680802)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0009, MALE/FEMALE DIFFERENCES IN FLYING SKILL ACQUISITION, FLIGHT SAFETY AND ACCIDENT PRONENESS, AND MOTIVATION FOR FLYING
J. ZVARA, Aerospace Systems Incorporated, *Burlington, Massachusetts* 01803 (DF232860; F33615-77-C-0028)

To investigate civilian male/female differences in flying skill acquisition, flight performance and safety, and motivation for an interest in flying.

A threefold approach will be utilized. First, a review of civilian aircraft accident data will be undertaken with an emphasis on determining if either sex appears disposed towards a greater incidence or type of accidents. Second, a field survey will be administered to a sample of 750 FAA flight instructors, and third, a field survey will be administered to samples of 750 male and 750 female FAA pilots. The emphasis of the field survey will be to determine the existence and possible impact of sex difference. Milestones: stage I, review of literature, 1.5 months; stage II, preparation and approval of survey instruments, 3.0 months; stage III, investigation of accident data (partly concurrent with stage II), 1.5 months; stage IV, survey administration, 2.5 months; stage V, analysis, 2.5 months; stage VI, preparation of final technical report, 3.0 months.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0010, ELECTROCARDIOGRAM DIGITIZER SYSTEM
D.C. FRASER, Charles Stark Draper Lab. Inc., *Cambridge, Massachusetts* 02139 (DF318480; F41609-75-C-0022)

The USAF central ECG library currently houses some 760,000 electrocardiograms (ECGs), the majority of which are on microfilm placed in transparent microfilm jackets. Because of their value in conducting research on ECG problems in aircrewmen, it is important to be able to digitize ECGs directly from microfilm. The purpose of this contract is to expand previously developed optical scan technology to automate conversion of ECGs from analog records into digital format suitable for digital computer analysis. This will entail definition, fabrication, delivery, installation and demonstration of hardware and software required for automated digital conversion of strip chart or microfilm records by optical scan techniques.

This effort is an expansion of a system acquired by the USAF School of Aerospace Medicine under Air Force contract for digitization of original electrocardiograms. This system utilizes a 512 element solid state scanning array and an electric threshold approximately one-half way between the extremes of array signal output and transmitting only the addresses of the transitions across the threshold to reduce the amount of data from 512 to less than 12 words per scan. System validation will be by means of ECGs from the USAF Central ECG Library. It will then be modified and mated with the additional hardware required to make it a stand-alone system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0011, DEVELOPMENT AND APPLICATION OF A TASK TAXONOMY FOR TACTICAL FLYING
R.P. MEYER, Design Plus, *St. Louis, Missouri* (DF223300; F33615-77-C-0020)

To develop a procedural methodology which TAC operational training personnel can use in the construction of continuation training programs for aircrews and to investigae the relationship of specific behaviors to the proficiency of aircrew skills. The product of this effort should provide reliable procedures for determining and structuring the content of aircrew continuation programs.

Application of a flying task taxonomy developed for TAC aircrew skills will be used. Taxonomic methodology will provide a conceptual structure for classifying flying training tasks into skill groups for comparison of inter-task relationships.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0012, BREADBOARD CHEMILUMINESCENT ANALYZER FOR MEASUREMENT OF HYDRAZINES
H. VOLLTRAUER, Aerochem Research Labs. Inc., *Princeton, New Jersey* 08540 (DF320330; F33615-76-C-0602)

This work unit will design, fabricate, test and deliver a laboratory breadboard instrument for continuous chemiluminescence detection of hydrazines and nitrogen tetroxide rocket propellants. This effort supports AFRPL-TN-2109-74-01, and the SAMSO/SAC requirement for confirmation instrumentation for the Minuteman III weapons system. It is 0art of a USAF-NASA cooperative program to develop a hydrazines measurement system to ensure compliance of human exposure to within OSHA and ACGIH threshold limit value concentrations for these toxic propellants.

Instrument design will embody concepts established from previous AMD study contract on chemiluminescence detection of hydrazines. Specificity will be obtained by either wavelength discrimination of the ozone-chemiluminescence reaction, or oxidative conversion of the propellant species. Target detection limits are 0.1 ppm in air for NeAt, monomethyl and/or 1,1-dimethylhydrazine and 0.5 ppm for nitrogen dioxide.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0013, CONCEPTUAL DESIGN AND MODIFICATION OF HUMAN IMPACT RESEARCH FACILITIES
J.A. BROWN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321460)

The success of research to define human exposure limits to emergency escape and aircraft crash environemtns and the development of design and evaluation criteria for personnel protective equipment in these environments is dependent upon the availability of adequate impact test facilities and equipment. The facilities must be capable of producing and measuring the complex acceleration-time histories that are experienced in USAF operations. Furthermore, they must be designed to meet the unique safety requirements associated with the use of volunteer subjects. The objective of this effort is to plan, design and/or modify impact test facilities and test fixtures required by experimental designs to meet USAF technology needs and operational safety requirements.

The capabilities of existing facilities and test equipment are assessed by test and analysis. Requirements for future research programs are studied to determine if these requirements can be met by existing equipment or by modification of this equipment. If new designs are required to meet the requirements, the design is developed through the conceptual phase and procurement specifications and plans are prepared and implemented. Operational performance capabilities and reliability of new and existing facilities are documented for review by laboratory engineering safety and human use committees. New instrumentation and data processing techniques are continuously investigated to improve measures of biodynamic responses and overall measurement accuracy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0014, APPLICATION OF HUMAN BODY MODELS
I. KALEPS, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF323100)

Sophisticated computer-based biodynamic models having a capability to predict in great detail both internal and external response of the human body resulting from high-level mechanical stress exposures have been developed. The present effort seeks to modify and refine these model formulations to optimize applicability to Air Force and flight operations oriented problems, to develop comprehensive graphic display capability to facilitate interpretation of analytically predicted results and to carry out model validations using experimental data obtained from separately conducted experimental programs at the Biodynamics and Bionics Division of the Aerospace Medical Research Laboratory and at other institutions.

This effort will emphasize the application of the head-spine model and the articulated total body (ATB) model to problems related to exposures of the head-spine system to high stresses and

human extremity excursions during whole-body accelerations, respectively. These models will be refined to accommodate complex restraint system properties, include rate-dependent force effects, define appropriate interactions with the environment corresponding to high mechanical stress flight operation conditions and allow use of broad anthropometric data bases for study of responses of various percentile subjects. Graphic displays of various degrees of sophistication will be developed and generated in hard-copy form, crt display or directly on film for time-sequenced examination. Parameter sets corresponding to selected experiments will be compiled and used for computer input for simulation of the particular experiments. Comparison of actual experimental results with predicted model output will be used as a basis of model validation and/or modification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0015, MANPOWER PREDICTION MODELS FOR SYSTEM SUPPORT REQUIREMENTS

F.A. MAHER, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF227540)

The major objective is to construct and verify models and procedures for predicting the impact of aerospace ground equipment (AGE) and hardware spares upon human resource requirements and establish trade-off potential positions. The intent is to predict human resource information that may be used for design trade-off decisions and for life cycle cost esimations. This will assist in insuring that a developing weapon system will be capable of operating efficiently within the limits of an established support budget.

Previous simulation techniques developed under task 112404 will be used as the foundation for the modeling effort. A data collection system relating human resource requirements to age and spares demands will be developed. The modeling of age and spares related maintenance will be accomplished by basic model modification, merging available peripheral programs and by developing new satellite programs. The final product will be a model which includes the variables of age and spares in addition to those variables already simulated in the work being completed under work unit 1124-04-03 which will be terminated by November 1974.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0016, MILITARY SPECIFICATIONS AND STANDARDS

J.M. RING, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320990)

There are two objectives: (1) to provide human engineering application, support and consultation at any and all stages of development--initial conception, concept evaluation, conceptual design, formulation, acquisition, testing, trouble shooting, and maintenance of systems and subsystems, and (2) to collect human factors research data and convert it into forms such as specifications, standards and handbooks that are directly usable by weapons system management and design personnel.

A diversified group of human factors specialists is maintained to respond to requests for assistance from AF, other government organizations, industry, and allied forces. The group assists in formulating the problem and makes recommendations for equipment design and for airborne and laboratory procedures, tests and evaluations, literature searches, data collection, and in-house and contract research programs. As requests for this expertise are received, the effort is recorded under this work unit until such time as the effort is sufficiently large to require its own documentation. This work unit provides human engineering participation to the (1) AFSC human engineering panel, (2) revision of human engineering specifications and standards, MIL-H-46855 and MIL-STD-1472, respectively, (3) revision of DH1-3, human factors engineering, and (4) aircrew station standardization panel. The results of the above efforts are utilized throughout the Air Force in the development of Air Force systems and equipment by incorporating them in contractual documents. In addition, MIL-H-46855 and MIL-STD-1472 are coordinated and used by all three services.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0017, EVALUATION OF HEARING PROTECTORS USING ANSI REAT METHOD

M.R. STEPHENSON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321330)

AMRL/BBA is responsible for evaluating personal hearing protectors for use in AF hazardous noise environments. The objective of this effort is to maintain our ongoing program of investigating hearing protection performance of helmets, head-sets and other sound protective devices. Hearing protectors submitted for evaluation will be measured for compliance with criteria established for acceptance on the Air Force qualified products list RE MIL Spec 38268b and considered for potential widespread or special purpose use in AF noise environs.

Human subjects will be employed in the laboratory evaluation of a hearing protector's sound attenuation characteristics as measured by the American National Standard Institute (ANSI) real ear attenuation at threshold (REAT) method. Results of these evaluations will be used to formulate recommendations to the Office of the AF Surgeon General concerning potential application for AF use. Data will be processed and prepared in formats consistent with general methods used by the scientific community as well as the AF for estimation of noise reduction in operational situations. This effort assures that our data base is current by evaluation of the many modified and new devices appearing on the commercial market in increasing numbers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0018, S-60 ENGAGEMENT MODEL

W.C. SUMMERS, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322880)

Develop a ground-to-air anti-aircraft artillery attrition model for the manual trackers in the soviet S-60 AAA weapon system with smaller modeling errors than currently available. This work supports HQ USAF studies and analysis modeling efforts. This effort will result in the development of a one-on-one engagement model for in-house analysis and reduction of S-60 simulator tracking data.

Integrate human tracker models from optimal control theory (developed under 6893-04-18) into the AFATL anti-aircraft artillery attrition model (P001). Investigate existing S-60 engagement software, system descriptions and data. Extract weapon subsystem descriptions whose modeling errors are comparable with the level of the tracker models and integrate them into P001 using covariance propagation where possible. Employ field test data to help estimate modeling errors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0019, EFFECTS OF HIGH ACCELERATION INDUCED BRAIN BLOOD FLOW DISTRIBUTION ON HUMAN OPERATOR PERFORMANCE

J. YODER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322450)

To measure the effect of gz acceleration on cerebral blood flow rate and the impact of this stress- response interaction on human operator performance. To evaluate the relationships of cerebral blood flow values determined by radioactive microsphere distribution to cardiac output. To determine the efficacy of cerebral blood flow rate manipulation in terms of performance enhancement. This technology will define those physiological criteria which contribute to the optimization of human performance.

The effect of acceleration on intracerebral blood flow distribution will be determined by the injected radioactive microsphere technique. The rationale of indirect assessment of cerebral perfusion on the basis of cardiac output determination will be tested. Cerebral blood flow distribution as determined by radioactive microsphere dispersion will be correlated with simultaneous dye dilution cardiac output determinations in animals. A broad spectrum of cardiac output values will be induced by provocative

measures such as cardiac pacing, and acceleration. Modification of the behavioral effects of acceleration-associated cerebral blood flow rate by a variety of flow augmentation techniques will be delineated in instrumented, performance trained animals.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0020, CRITERIA DETERMINATION OF THE ADVERSE EFFECTS OF LIGHT ADAPTATION IN THE NAVAL AVIATOR

G.T. CHISUM, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN133013)

To develop the requirements for protection of the human visual system against adverse light adaptation situations which occur in combat conditions and in the use of devices such as novel eye position sensing systems and low light level viewing and display devices which are both operational and are being designed for use by naval aviators. The requirement for work in this area is established by naval research codes PA-10, LS4 and LS5 of the FY 1974 naval aviation biomedicine/human effectiveness technical workshop report.

Electroretinograms will be recorded from human observers following exposure to adapting light stimuli. Conditions to be varied are the level of light adaptation, the intensity of the adapting stimulus, and the duration and chromatic composition of the adapting stimulus. Of special interest will be the effects of eye position sensing pulses (including laser pulses) such as are used with some head-coupled weapon control and guidance systems and chromatic adaptation of the type encountered in the use of low light level viewing and display systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Medical Research Institute

6.0021, SENSATIONS OF MOVEMENT AND CHANGES OF PERCEIVED ATTITUDE IN DYNAMIC FLIGHT SIMULATION

M.M. COHEN, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN581102)

To determine thresholds and transfer functions describing human sensory responses to linear and angular accelerations. To determine how linear and angular accelerations interact to produce sensations such as those encountered in actual aircraft flight maneuvers. To employ the derived transfer functions in controlling the NAVAIRDEVCEN human centrifuge, enabling its extended application in research, development, evaluation and training.

Threshold and transfer functions for human sensory responses to combined linear and angular accelerations will be determined and used to control the NAVAIRDEVCEN human centrifuge as a dynamic flight simulator. Because simulators do not duplicate the precise accelerations and motions of aircraft maneuvers being simulated, it is necessary to substitute other motions and accelerations so that the pilot is minimally aware of any substitution. For an adequate substitution of accelerations to be achieved, it is imperative to understand now linear and angular accelerations are perceived by human observers and how they interact under a wide range of conditions. The proposed research will measure thresholds and transfer functions for human sensory responses to linear and angular accelerations, and will determine what trade-offs can be made between linear and angular accelerations in dynamic flight simulation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

6.0022, ASSESSMENT OF PERFORMANCE BASED ON FUNCTIONAL VISION

J.V. DEVINE, Univ. of Texas, School of Liberal Arts, *El Paso, Texas* 79902 (DF314960; F41609-76-C-0002)

The objective of this effort is to determine changes in functional vision resulting from operational and weapons hazards to which Air Force crew members may be exposed during mission performance. Nonionizing radiation (RF and laser emitters) as well as ionizing hazards (tactical nuclear weapons) must be assessed for the development of survivability/ vulnerability mathematical models of aircrew performance during specific Air Force missions. Functional vision decrements must be established based on a series of nonhuman primate experiments which employ empirical procedures to determine the minimal amount of energy density which produces a just noticeable difference in visual perception as measured by standard psychophysical procedures.

This effort involves the determination of pre-exposure visual capability as measured by functionally tracking moving targets, quantification of eye damage, post-exposure visual capability, and follow-up assessment of functional vision. Measures of tracking ability before and after retinal lesion placement will be compared to the known visual acuity loss obtained following similar lesions in the fovea as accomplished under contract F41609-75-C-0002. Stable baseline data will be obtained prior to experimental utilization and follow-up assessment of functional vision will be accomplished for a minimum of 10 days. Ophthalmoscopic examinations, fundus photography, angiograms, and appropriate histological procedures will be accomplished as part of the follow-up assessment procedure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, BIOCHEMICAL LONG-TERM RISK FUNCTION EVALUATION

D.A. CLARK, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321890)

The objective of this work will be to test the predictive power of biochemical measurements suspected to be involved in the development of atherosclerosis in USAF aircrew. This is necessary because the extent of coronary artery disease (CAD) in susceptible individuals cannot be completely predicted using the present accepted risk factors for CAD.

The laboratory accuracy and precision of possible biochemical risk factors will be defined and improved as much as possible. If appropriate, determinations will be made on patients having had coronary angiography as part of their routine evaluation. The laboratory data will be tested statistically to determine if the biochemical measurement discriminates between patients with and without coronary artery disease. Progress under this work unit was previously documented under 7755-05-07.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0024, DEVELOPMENT OF A PILOT SELECTION SYSTEM

D.R. HUNTER, U.S. Air Force, Human Resources Laboratory, *San Antonio, Texas* 78236 (DF232530)

To collate results of pilot selection studies conducted by AFHRL over the previous 7 years and to use that base for making recommendations for further research and for pilot selection systems that could be implemented by Air Training Command.

The results from previous pilot selection studies conducted by AFHRL will be analyzed and the relative merits of each of the proposed selection instruments considered. The relative contirubtions of each of the instruments to prediction of pilot training outcomes will be considered in recommending the development of a pilot selection system, as will the practical problems of implementing such a system. Based upon the previous studies a course of research will be proposed to cover improvements in existing and proposed selection systems along with promising avenues of research that have not been fully explored.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0025, EYE EFFECTS OF NUCLEAR DETONATIONS

N.E. LOF, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF318160)

Field tests and laboratory experiments have shown conclusively that flashblindness and retinal burns caused by a nuclear detonation can be a hazard to aircrews at far greater distances than other immediate nuclear weapon effects (blast, thermal, ionizing). The objective of this effort is to 1) apply existing

knowledge and obtain required experimental flashblindness data for the s/v program, 2) provide predictions of nuclear flash eye safe separation distances, 3) evaluate the eye hazard associated with the use of high-intensity light sources in AF research and development projects, 4) calculate the eye protection required for safe viewing of high-intensity light sources, and 5) act as a consultant on flashblindness protective device requirements and development.

Existing prediction models and techniques will be tested against available experimental data and modified as necessary for adequacy and accuracy. Programs will be modified as necessary to furnish output in a format compatible with input requirements of s/v models. Generalized nuclear flash eye effects and protection requirements will be provided to using agencies in the form of technical reports. Predictions and consulation will be furnished using agencies for specific situations upon request. Cognizance of new materials development will be maintained for possible use in flashblindness protective devices. Promising materials will be tested and evaluated and recommendations reported.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, MEASUREMENT AND DETECTION OF AMINE-BASED ROCKET FUELS

L.J. LUSKUS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320860)

This effort provides detection concepts and prototype instrumentation/methodology for monitoring extremely hazardous and toxic amine-based rocket propellants. Development of area detectors, personal dosimeters and other monitoring devices is urgently needed for handling, transfer and sampling of amine fuels such as hydrazine, MMH and UDMH. The requirement exists both in rocket testing and missile maintenance to provide maximum lead time for donning of protective garments, and to insure a continuous record of occupational exposure. This work supports AFRPL-TN-2109-74-01. Previous accomplishments in the area of hydrazine fuel instrument/methodology development are documented under work unit 71641614. This work unit is established to implement a new technology planning objective as directed by HQ Aerospace Medical Division.

Electrochemical and chemiluminescence instrumentation will be developed and evaluated for use as area and confirmation monitors. Personal dosimeters will be developed contractually with final evaluation and testing accomplished under this work unit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0027, THERMAL EVALUATION OF ANTI-EXPOSURE EQUIPMENT

S.A. NUNNELEY, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320170)

The goal is to optimize anti-exposure protection for USAF operations over cold water. ASD has requested realistic guidance which will allow operational units to select a clothing ensemble which causes minimal encumbrance consistent with reasonable safety standards. These will take the form of tables entered with water temperature and predicted maximal pick-up time.

A stepwise approach is necessary, as follows: (1) determination of air and water ClO values (performed at USARIEM per MOA), (2) preliminary guidance to field, (3) development of computer model for prediction of self-help and survival limits, (4) validation of same, and (5) revision of field guidance. All work is being coordinated with USN (NADC).

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0028, UPGRADE OF COCKPIT ENVIRONMENT SPECIFICATION

S.A. NUNNELEY, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322610)

Previous efforts in this area were documented under work unit 7930-09-15. The purpose of this effort is to conduct in-house test and evaluation of chemical defense personal equipment in direct support to the 412A Life Support SPO, Chemical Defense Division (AEL). The workunit is structured to address biomedical and environmental test requirements that are expected to arise during various stages of new equipment development and modification of existing equipment by the SPO. The capability to conduct quantitative leakage assessment of CD respiratory devices will be established and the chemical properties of CD filter materials will be studied for their compatibility with the flight environment. The justification for establishing this supportive effort is based upon an approved memorandum of agreement between AMD and ASD/AEL (30 Jun 76), and TAF (ROC) 326-75, 7 Nov 75 (CW mask for tactical fighter aircrew). The MOA states that T&E support will be provided on a cost reimbursement basis, the latter defined as a specific cost schedule in AMD letter to ASD/AEL, 9 Feb 76.

The work-unit monitor will serve as the OPR for the CD program to be accomplished within the USAFSAM. He will plan programs and coordinate all T&E activities to be accomplished by various organizations within the laboratory. However, laboratory elements at both the USAFSAM and AMRL will charge against this work unit to insure proper reimbursement. Specific areas of test and environmental simulation will consist of altitude exposure, including pressure breathing levels and rapid decompression, respiratory impedance measurements, thermal/cold effects, air combat manuevering (ACM) g exposures, mask leakage characteristics, equipment-related performance decrement, and integration with other life support equipment and cockpit configurations. Realistic operational profiles for the environmental conditions will be simulated and the sodium chloride cloud technique will be utilized for lead testing purposes (actual CW agents, simulants or antidotes will not be used for any tests). The OPR and others will also provide biomedical consultation and review technical requirements for equipment design when requested.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0029, POSITIVE PRESSURE BREATHING SYSTEMS TO INCREASE G TOLERANCE

R.M. SHAFFSTALL, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322280)

To evaluate the efficacy of positive pressure breathing both with and without thoracic counter pressure garments as a method for improving acceleration tolerance, and secondly to establish optimum schedules and methods of application of positive pressure breathing in terms of acceleration level and breathing pressure.

The approach will be to establish the efficacy and feasibility of using positive pressure breathing to increase acceleration tolerance by testing pre-g onset of constant-level positive pressure breathing both with and without counter-pressure garments and anti-g suits against currently employed methods of acceleration protection. The evaluations will be conducted on the USAFSAM human centrifuge using two acceleration profiles: the first will test the subject's relaxed tolerance and the second will utilize straining techniques and evaluate fatigue tolerances in a rapidly changing acceleration environment (WU 7930-12-07). If the use of pre-g positive pressure breathing proves effective, a second phase of experimentation will be initiated to determine optimum g levels for the onset of partial pressure breathing and breathing pressures per g level. This information will be used to develop criteria for a positive pressure breathing regulator (WU 7930-11-XX) and the integration of positive pressure breathing with high oxygen concentration in the inspired gases as a method to reduce atelectasis which occurs during high g exposure (WU 7930-11-20).

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0030, INTEGRATED AEROMEDICAL DATA BASE AND DECISION SYSTEM

G. TOLAN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322070)

The primary objective of the integrated aeromedical data decision system is to facilitate follow-up studies on fliers evalu-

ated in the past in order that waiver authorities can better determine whether today's fliers with the same findings should be returned to duty. Additional objectives include identifying candidates for special studies, determining the probability of obtaining a waiver for any given condition, and describing the medical profile of special study groups.

In order to reduce data capture errors, state-of-the-art as well as innovative methods will be implemented that capture data as close in time and place to its creation as is possible. Data will then be machine verified and echoed back to its source for reconfirmation. In order to permit correlation of a patient's data across different source-oriented medical data repositories, an algorithm for verifying each patient's unique identifier will be implemented. In order to protect uniquely identifiable medical data from unauthorized access or alteration, while simultaneously increasing the data availability to the end users, repositories will be incorporated into a data base management system. Efforts were previously under work unit 7755-14-08.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0031, DEVELOPMENT OF A CAPABILITY TO AUTOMATE AMBULATORY BLOOD PRESSURE RECORDINGS
R.L. WOLTHUIS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321680)

It is very difficult to differentiate between labile blood pressure elevations and fixed hypertension since blood pressure measurements cannot be made during routine daily activities. This effort will define the usefulness of ambulatory blood pressure measurements in identifying aircrewmembers who have significant hypertension and the effectiveness of drug therapy while on waiverable medications.

Two automated ambulatory blood pressure recorders have been manufactured and modified to this laboratory's specifications. This effort will define the reliability and accuracy of these recorders. The blood pressures recorded during routine ambulation will be correlated with the blood pressures obtained during orthostasis and exercise in normotensive and hypertensive aircrewmembers. This work was formerly documented under work unit 7755-01-05.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0032, ADVANCED HELMET-MOUNTED SIGHT (AHMS)
A.R. DERUYCK, Polhemus Navigation Sci. Inc., *Burlington, Vermont* (DF322380; F33615-77-C-0513)

To design, develop and fabricate a laboratory grade advanced helmet-mounted sight (AHMS) system that will provide six degrees of freedom position information of a subject's helmet in suitable output format necessary for integrating it into the visually coupled airborne system's simulator (VCASS) program. Two additional objectives of this program are to develop a suitable integration of the AHMS system with state-of-the-art wide field-of-view (FOV) side-mounted helmet mounted display (HMD) optics and cathode ray tubes (CRT) and to develop a long-range multiplexed AHMS system which will allow resolution of helmet position and attitudes at distances far greater than those required in high-performance aircraft.

This effort will be divided into four phases: (1) conceptual design phase, (2) detailed design and fabrication phase, (3) test phase, and (4) engineering support phase. Each of these phases shall concentrate on four major areas of development: (1) primary AHMS hardware and programming, (2) hardware and programming for the long-distance multiplexed AHMS (LAHMS), (3) hardware and programming necessary to provide integrated HMD/AHMS (HAHMS), and (4) system electronics processing and control circuitry. Each phase has predetermined goals which must be met in each of these four areas before work can proceed into the next phase. Finally, sufficiently severe testing is performed in characteristic environments to assure that VCASS requirements are met and that system viability for a follow-on airborne qualified system is achieved.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0033, PHYSIOLOGIC OXYGEN DELIVERY DURING INTERACTIVE ENVIRONMENTAL STRESSES
M.P. HLASTALA, Univ. of Washington, School of Medicine, *Seattle, Washington* 98122 (DF319780; F41609-76-C-0016)

Proposed airborne breathing systems such as on-board open/closed loop oxygen generating systems require development of new specifications for breathing gas composition. The purpose of this effort is to develop a tool, composed of a series of interactive mathematical formulations based on physiologic entities, which will provide rationale and criteria required to establish design specifications for advanced oxygen systems. Specifications to replace the current MIL-D-l9326 and MIL-D-8683 must apply to specific aircraft types to accommodate the particular interactive stresses imposed. Revision of MIL-R-83178, to conserve oxygen for on-board generating systems, must provide for protection from decompression and performance decrements associated with low-grade hypoxia, while at the same time preventing atelectasis and other physiologic derangements caused by high oxygen concentrations. The eventuality of deploying open/closed loop oxygen generating systems on high-performance aircraft such as the F-16 and F-15 requires assessment of the effects of multiple interactions including acceleration, altitude, and breathing gas composition. Currently there is no specification for carbon dioxide accumulation levels in pressure suit helmets or helmets to be used for protection from toxic atmospheres. Interactive effects of carbon monoxide must also be considered for smokers and those using oxygen generators producing low levels of carbon monoxide. The importance of this effort and characteristic which differentiates it from previous work is its comprehensive treatment of multiple physiologic stresses specific to aircrew environments. This formulation will also enable realistic physiologic assessment of specific conditions imposed by equipment tested and evaluated in-house at USAFSAM. Further, it will define critical levels of breathing gas partial pressure for correlation with data on performance decrements.

Development of biomedical criteria and specifications for safe physiologic limits for the constituents of breathing gases requires an integrated systems analysis of the physiologic system both with respect to the multiple variables of inspired concentrations, acceleration and altitude and with respect to the realtionships between lung, the circulation and the body tissue beds. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NUMERICAL DYNAMIC ANALYSIS OF STRUCTURES BY THE FINITE DYNAMIC ELEMENT METHOD
J.K. GUPTA, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DF046950; AF-AFOSR-3276-77)

AF function - design of aerospace vehicles. Opportunity - the finite dynamic element method has been developed for efficient free vibration and dynamic response analysis of large and complex structures. Objective - the finite dynamic element method will be developed for the discretization of the continuum involving plane stress/strain, plate bending, shell and solid of revolution elements. How work contributes -more effective structure analysis techniques could develop from this work.

Using the concepts of the finite dynamic element method, six dynamic elements pertaining to various continuum will be developed and implemented in computer programs. Two eigenproblem solution procedures for the quadratic matrix equations will be studied and implemented. The free vibration analysis program will be extended to yield a dynamic response analysis capability. This will be achieved by the model superposition method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, STABILITY OF NUMERICAL SCHEMES THAT CONTAIN A MESH REFINEMENT

J.W. THOMAS, Colorado State University, School of Natural Sciences, *Fort Collins, Colorado* 80523 (NCA 2-165801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0003, GENERAL PURPOSE 2-D ELASTICITY COLLOCATION CODE

P.G. TRACY, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4810)

The objective of this project is to develop a general formulation and associated computer coding for the calculation of the stress intensity factors, stress concentration factors, displacements, and stress states which are needed to assess the operational life and reliability of Army material. The code will be written in a modular construction allowing rapid formulation and solution for such diverse problems as partially closed cracks in residual stress fields of pressurized tubes and cracks emanating from riveted aircraft structures.

The modified-mapping collocation method developed at AMMRC will provide the analytic approach to be used.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

7.0004, ANALYSIS DEVELOPMENT FOR DYNAMICS DATA REDUCTION

D.L. BROWN, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF139060)

This work unit supports the functions of the vibration and aeroelasticity facility for providing analysis of dynamics data. The broad problem is to provide state-of-the-art capabilities required for the recovery, analysis, and presentation of dynamics data which describe the operating environment of military flight vehicles and assess the accuracy of analytical prediction methods. The objective of this work unit is to integrate hardware to increase data recovery capabilities and to develop software for the analysis system that will advance the existing analysis and graphics capabilities. This will result in improved performance and advanced capabilities in the analysis of vibration and acoustic problems that occur during military operations.

The dynamics data analysis process consists of four parts: (1) data recovery and analog analysis, (2) analog-to-digital conversion, (3) digital analysis, and (4) graphic data presentation. The capabilities in the data recovery and a/d conversion areas will be increased by optimizing and upgrading the existing system components and by integrating new hardware into the system. The data analysis and graphics capabilities will be advanced by developing software and digital processing techniques to apply more sophisticated analysis procedures and to provide more graphic data presentation formats to increase the overall interpretability of the analysis results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0005, COMPUTER ENGINEERING INVESTIGATIONS FOR THE AFAMRL

L. CRUM, Wright State University, School of Science & Engin., *Dayton, Ohio* 45431 (DF047820; AF-AFOSR-3244-77)

AF function - human operator performance is of central importance to USAF manned weapon system effectiveness. There is an immediate need for research on the effects of motion and operation environmental stresses on the air crew member, to improve air-to-air attrition programs and to improve design of motion base simulators within the Air Force. Deficiency - research is needed to evaluate the human operator subsystem and the effects of environmental stress on performance. An analytical description of the operator is needed to replace manned simulation and costly flight tests for each new weapon system. Objective - this work proposes to extend preliminary work recently conducted at AMRL on the investigation of computer simulation and analysis of nonlinear systems. How research contributes - this work should provide significant contribution to ongoing and planned work at AMRL dealing with the applicability of appropriate mathematical techniques toward the study of human operator performance. It contributes directly to sub-area 1.10, 'human operator performance modeling techniques'.

The research proposed endeavors to mathematically model human operator performance and to verify the model's applicability in a variety of tracking situations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, INVERSION OF ISOPARAMETRIC MAPPINGS AND APPLICATIONS OF COMPUTER GRAPHICS TO 3-D FINITE-ELEMENT ANALYSIS

C.A. HALL, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh, Pennsylvania* 15260 (DF044020; F44620-76-C-0104)

AF function - the design of 3-d structures for future aerospace vehicles. Deficiency - more effective and versatile analytical and computational methods are needed for the design of 3-d structures. Objective - this research intends to develop computational techniques for solving structural design problems by the use of numerical analysis and computer graphics techniques. How work contributes - a computational and graphical presentation technique for analyzing complex 3-d structures will be developed.

This research effort includes (1) extension to 3-d isoparametric elements the characterization of bijectivity (one-to-oneness), (2) to develop the bigradient algorithm for numerically inverting the 3-d 20-node isoparametric element and study its efficiency, (3) to develop a computer graphics package to plot intersections of a given plane with a union of isoparametric bricks, (4) to investigate efficient means of computing and graphically representing the resolution of stress distributions in a given plane of intersection, and (5) to investigate the effect on finite-element solution of quadrature error introduced due to the isoparametric change of variables.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, VERIFICATION/VALIDATION OF SPACE SHUTTLE FLIGHT COMPUTER PROGRAMMING LANGUAGE (HAL/S)

J.C. BROWNE, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NSG 1479)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0008, SPLINE FUNCTIONS AND APPROXIMATION THEORY

C. DEBOOR, Univ. of Wisconsin, Mathematics Research Center, *Madison, Wisconsin* 53706 (DA0M9695; DAAG29 75 C 0024)

Spline functions and approximation theory are particularly appropriate for situations where conventional mathematical techniques are not applicable. These techniques have been and can be used in designing weapon systems and aircraft systems and are appropriate for analyzing test data from many military sources. The objective is to develop approximation theory including spline functions, to be applicable to the solution of differential equations, numerical integration, and interpolation problems amongst others.

Professors I.J. Schoenberg and C. De Boor, who are two very well-known researchers in spline functions, are both MRC members. The presence of these two outstanding mathematicians on the MRC staff draws many distinguished visitors to MRC, and the interaction of these people, together with personal and written communications with others in this area, has resulted in an extremely productive research group. A popular seminar on the subject has captured the interest of many MRC members as well as U.W. faculty and students. Computational experimentation has been enhanced by access to the U.W.'s UNIVAC 1110, particularly that provided by a remote keyboard terminal.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, A STUDY OF STRUCTURAL PERTURBATION EFFECTS ON POLARIZED LIGHT SCATTERING SIGNALS FROM RAYLEIGH AND MIE PARTICLES
W.S. BICKEL, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (10160AC6)

SUPPORTED BY American Chemical Society

8.0002, INTERACTIONS OF INFRARED RADIATION WITH SOLIDS
A.A. MARADUDIN, Univ. of California, School of Physical Sciences, *Irvine, California* 92664 (DF041700; AF-AFOSR-2887-76)

AF function - high-energy laser technology is finding wide application in future Air Force systems. Opportunity - both in the production of intense radiation and in the hardening of certain critical components to this radiation, the interactions of photons with matter is of extreme importance. Objective - rather than trial-and-error testing of a wide variety of materials this research seeks a fundamental understanding of the quantum interactions of infrared radiation with solid materials. How work contributes - such investigations should lead to the formulation of macroscopic theories of the linear and non-linear interaction of light with matter and the development of microscopic theories of the basic material parameters that enter the analysis and diagnosis of macroscopic material properties and behavior. An understanding of infrared absorption in insulators semiconductors by multiphonon processes can provide a basis for the optimization of laser windows and mirrors.

Specific attention is given to the absorption of infrared radiation by conduction electrons in n-type polar semiconductors and by holes in p-type materials of the diamond or zinc blende structure. The shape and size dependent effects in materials which exhibit a gyrotropic response to electromagnetic radiation is being examined. Non-linear interactions between infrared waves and matter in the solid state is being studied in terms of a microscopic theory of the third order non-linear electric susceptibility and surface polaritons.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0003, INVESTIGATION OF SOLID-SOLID REACTIONS OF METAL FILMS ON SILICON 14931-MS
T.J. MAGEE, Advanced Res. & Applic. Corp., *Los Altos, California* 94022 (DA0F8999; DAAG29 77 C 0024)

To characterize the kinetics and mechanisms of solid-solid reactions in gold-silicon, aluminum-silicon, and silver-silicon systems. Relevance - the research is relevant to silicon device fabrication technology. A number of programs at NVL involve the development of silicon charge-coupled devices for imaging and signal processing applications, as well as ohmic or nearly ohmic silicon devices for cryogenic operation. ECOM and HDL state that the proposal is relevant to a broad spectrum of semiconductor devices, especially the reliability of military devices.

The program will include determination of the energies of activation and the mechanisms of diffusion and characterization of the microstructural and electrical features of the above systems, to include a study of the effects of various thermal treatments.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0004, APPLICATIONS OF CARS SPECTROSCOPY TO TURBULENCE MEASUREMENTS
R.L. BYER, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (NSG 2289)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0005, AN INVESTIGATION OF THE PERFORMANCE, APPLICATION POTENTIAL, AND INHERENT LIMITATIONS OF A NEW MICROANALYTICAL INSTRUMENT (THE AUGER MICROPROBE)
G.M. POUND, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 2285)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0006, THEORETICAL STUDIES OF ELECTRONS IN SOLIDS
W. KOHN, Univ. of California, Graduate School, *San Diego, California* 92037 (DMR76-82422 A01)

Research in the theory of solids with special emphasis on surface-related phenomena previously supported by NSF grant DMR75-02974 A01 will be continued. Four areas of research will be pursued: (1) Surface physics: development of the fundamental theory underlying the density functional formalism: theory of physisorption; indirect interactions between atoms adsorbed on surfaces; scattering of positrons from surfaces to determine the surface dipole barrier potential. (2) Interfaces: dielectric formulation of interface energy; asymptotic perturbation or electron density far from the interface; interface electronic structure by self-consistent moment methods. (3) Generalized Wannier Function: Application to impurity states in semiconductors. (4) Theoretical work on a solar energy (photothermal) system. Surface science continues to be in a state of rapid development, in terms of concepts, new experimental measurements, and theoretical methods. This work will contribute to this development. In addition to its fundamental scientific interest this work will also have impact on such applications as adhesion, grain boundaries, catalysis and solar energy conversion.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0007, CATALYSIS AND SOLID-STATE PHYSICS
M.B. MAPLE, Univ. of California, Graduate School, *San Diego, California* 92037 (DMR76-24178 A01)

A continuation of research funded by NSF grant DMR75-23385 will be pursued. This is a joint theoretical and experimental effort to study the various problems concerning the chemisorption of gases and the catalysis of chemical reactions over solid substrates.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0008, METAL VAPOR PLASMAS CREATED BY LASER ABLATION
R.M. MEASURES, Univ. of Toronto, *Toronto, Ontario, Canada* (DF041850; AF-AFOSR-2902-76)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment and development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand new types of highly efficient and effective lasers. Such lasers are metal vapor lasers. Deficiency - little information is available today in understanding the fundamental processes of operation of metal vapor laser. Its acquisition may be realized by a well-planned theoretical and experimental research. Objective - this project will investigate both theoretically and experimentally laser ablated metal vapor plasmas, using selective laser excitation spectroscopy to study the dependence of the degree of excitation of the metal vapor plasma upon the wavelength and pulse duration of the ablation laser. Contribution

- this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This project will study metal vapors, metal plasmas, metal excimer and metal exciplex systems created by laser ablation. To accomplish this goal a laser ablation facility is being built. This facility will enable one to determine the dependence of the degree of excitation of the metal vapor plasma upon the characteristics of the ablation laser. Such measurements are important in evaluating the optimization of laser ablation for the purpose of creating metal vapor plasmas and seeding various gaseous systems with metal vapor. In addition measurements will be made of the strength of various atomic transitions in materials that are either highly refractory or difficult to handle. The aforementioned facility will be used to measure reactant lifetimes, chemical reaction rates and collision rates useful to the aforementioned objective.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0009, PHYSICAL PROPERTIES OF IR SEMICONDUCTOR MATERIALS

E.D. PALIK, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620098)

To obtain a basic knowledge of the physics and chemistry of semiconductor materials particularly those aspects important in the development and characterization of materials needed for high-performance and/or less expensive electronic devices and components. To investigate the bulk, surface, and thin-film optical and electronic properties of a number of semiconductors for possible infrared and microwave device applications. To study the interaction of electromagnetic radiation and semiconductor materials.

Surface and interface properties, lattice-vibration parameters and electronic band structure are studied with a variety of optical techniques. Optical reflection, transmission, and attenuated-total-reflection are the primary experimental approaches.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0010, SPECTROSCOPIC ABSORPTION MEASUREMENTS OF ATMOSPHERIC OH

C.R. BURNETT, State University of Fla. Sys., School of Science, *Boca Raton, Florida* 33432 (ATM77-19636)

This grant will fund spectroscopic absorption measurements of atmospheric OH. The hydroxyl molecule (OH) is one of the principal generally reactive species in the upper atmosphere. It directly controls the concentration of ozone above 40 km and has a strong influence on the partitioning of the odd-nitrogen and odd-chlorine compounds which affect the main ozone layer at about 25 km altitude. Theoretical atmospheric models which are used to predict the effect of anthropogenic activities on ozone abundance are dependent on experimental measurements for representative concentrations for the reactive species. At the present time, measurements of stratospheric OH are very limited. The success of ground-based spectroscopic absorption measurement for the total column abundance of atmospheric OH has been demonstrated. The observations funded by this grant will help to establish the average annual daytime abundance of OH and will begin to contribute information as to possible seasonal, geographic, and short-term variations.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

8.0011, CALCULATION OF ELECTRON IMPACT CROSS SECTIONS FOR METASTABLE STATES IN ATOMIC AND MOLECULAR GASES

M.R. FLANNERY, Georgia Inst. of Technology, School of Physics, *Atlanta, Georgia* 30332 (DF459170; F33615-76-C-2033)

Development of appropriate theories for predicting electron impact excitations of excited atoms and molecules. Calculation of electron impact cross sections from metastable states for selected atomic and molecular gases. This research directly contributes to the Air Force requirement for high-power coherent and incoherent light sources. Cross sections are not well known for indirect excitations from excited or metastable states. In order to correctly model and control the light source, electron impact cross sections must be known. Evidence exists that indirect excitations play a very important role in determining the energy balance in gas discharge lasers. This research is of immediate interest in furthering the development of coherent light sources.

The multichannel eikonal treatment will be applied to the excitation processes while the Born approximation will be applied initially to the ionization processes. The binary encounter method will be modified so as to treat ionization of molecules. Also the eikonal approximation will be generalized and applied to ionization. Moreover, certain developments in the theory of ionization will be required so as to provide a description of ionization more accurate than the various theories that are at present available and to derive therefrom relative excitation and ionization probabilities from metastable excited states. The functions to be calculated shall be in the order of priorities listed or as coordinated with the technical monitor. The theoretical methods from atoms and for molecules shall be studied in parallel rather than sequentially.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

8.0012, MATERIAL SUPPORT TECHNOLOGY - SOLID-STATE REACTIONS ON SEMICONDUCTORS

E.J. SCHEIBNER, Georgia Inst. of Technology, Engineering Experiment Station, *Atlanta, Georgia* 30332 (DN575362; N00014-75-C-0909)

The development of advanced, reliable devices and new device fabrication techniques for solid-state electronics devices will require increased knowledge and data about solid phase reactions. This research task will explore the chemical and physical reactions which occur at the solid-solid interfaces between various electronic materials.

Using the techniques of Auger electron spectroscopy (AES) and X-ray photoemission spectroscopy (XPS), studies will be made of the chemical effects which occur at the interfaces of various solid materials. These materials will be processed at temperatures such that only solid phase reactions can occur. The chemical information is derived from 'chemical shift' information inherent to the Auger and photoemission spectroscopies. Reaction kinetics will be analyzed and concentration profiling of the thin layered films will describe the solid phase processes which occur. The systems of prime concern are the metal-oxide interface on silicon (thermal oxide) and on gallium arsenide (anodic oxide) and the metal-semiconductor interface on the same semiconductors. MOS and Schottky barrier test structures will be fabricated and the chemical results correlated with electrical measurements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0013, COMMUNICATIONS - SOLAR RADIATIONS IN NEAR SPACE AND THEIR EFFECTS ON THE EARTH'S MAGNETOSPHERE AND IONOSPHERE

J.A. VANALLEN, Univ. of Iowa, School of Liberal Arts, *Iowa City, Iowa* 52240 (DN624361; N00014-76-C-0016)

The performance of naval communications, detection, and navigation systems is degraded or disrupted by ionospheric disturbances caused by energetic particle precipitation and by solar radiation. Research on energetic magnetispheric and interplanetary energetic particles and their interaction with electromagnetic and shock waves, and on solar emission of radio frequency and X-rays and energetic particles will lead to understanding of the causes of magnetic storms, ionospheric disturbances, and communication blackouts.

Experimental measurements of energetic particles, electric, magnetic, and electromagnetic fields are taken in the magnetosphere, polar cusp, and solar wind. Solar emission of energetic particles and X-rays are measured and the effects on the iono-

sphere determined. Interplanetary scintillation is measured using radio interferometry techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0014, THE EFFECTS OF TEMPERATURE AND HYDROSTATIC PRESSURE ON THIN FILM OPTICAL ADSORPTION SPECTRA

A.D. BROTHERS, Benedictine College, Undergraduate School, *Atchison, Kansas* 66002

SUPPORTED BY Research Corp.

8.0015, COMMUNICATIONS - ATOMIC CLOCK CORRECTION FOR GRAVITATIONAL POTENTIAL

C.O. ALLEY, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DN475349; N00014-76-C-0560)

The objective is to evaluate Navy timekeeping and synchronization methods currently in operation at the U.S. Naval Observatory. Evaluation of the time effect due to the gravitational potential following transport of atomic clocks from part of the globe to another will allow for standardization of synchronization procedures and estimation of true drifts in cesium atomic clocks. The accuracy in the use of portable clocks in the 'calibration' and certification of the DCS SATCOM ground station clocks will thus be investigated.

Work consists of flying a set of cesium atomic clocks to estimate the time delays due to general relativity effects. This includes measurements on possible difference in clock rates between (1) near equatorial and near polar latitudes; (2) northern and southern latitudes at the times of the solstices; and, (3) the effect of earth rotations by east-west and west-east circumnavigation flights.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0016, NOISE AND PROPERTIES OF MATERIALS AT LOW TEMPERATURE FOR APPLICATION TO GRAVITY GRADIOMETRY

J. WEBER, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DF048190; F49620-77-C-0065)

AF function - gravity gradiometers are being developed to conduct gravity surveys over unmapped ocean areas to determine more precisely the deflection of the vertical along missile flight paths. Deficiency -the missile CEP requirements for the period 1990 are such that the gravity gradiometers will have to have an accuracy of ten to the minus 12 g/m. Although the present technology of electronic components has reduced the thermal noise levels within the system to their equivalent Brownian motion, cryogenics techniques will have to be investigated to make any significant reduction in noise levels to meet the required specifications for future gravity gradiometers. Objective - this research will establish the procedures and cryogenic techniques required to operate future extremely sensitive instrumentation in a controlled environment. Contribution - inertial navigators are ultimately limited in accuracy by the determining of the local gravity field (deflection of vertical). Therefore, improved gravity gradiometers will provide the necessary data to determine the deflection of vertical during flight paths or operation.

Different materials will be selected to study the noise and attenuation factors at liquid nitrogen temperature (4.2 degrees Kelvin). These materials and cryogenic techniques will be investigated to determine their applications for use in gravity gradiometers. Material to be investigated will include aluminum, sapphire and niobium.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0017, HIGH-RESOLUTION VACUUM ULTRAVIOLET SPECTROSCOPY OF SMALL MOLECULES

W.H. PARKINSON, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (DF045930; F49620-77-C-0010)

AF function - surveillance, detection and communications, laser development in the near UV region of the spectrum. Deficiency - there is a lack of sufficient data to characterize the degree of photopredissociation of N2 in the upper atmosphere. Adequate understanding is lacking of the detailed spectroscopy and dynamics of rare gas excimers which can act as VUV lasers or energy storage states for transfer to the upper laser level of other species. Objective -determine photopredissociation processes in N2 at 800-1000 Angstroms and determine high-resolution vacuum ultraviolet spectroscopy of Van der Waals molecules. How work contributes - a high-resolution spectroscopic investigation of the photopredissociation of N2 as a source of excited N2D atoms is important in determining the amount of vibrationally excited NO molecules in the upper atmosphere which are produced by reaction of N2D with O2. The lowest excited electronic states of the Van der Waals molecules such as the diatomic rare gas molecules are important to the development of intense VUV sources and lasers. Spectroscopic investigation of these molecules will establish important structural features of the molecules.

A 6.6 metre vacuum ultraviolet spectrograph with extremely high resolution will be used to study (a) photopredissociation processes in N2, which in the 800-1000 Angstroms region are important sources of N2D in the upper atmosphere, and (b) the spectroscopy of Van der Waals molecules which possess laser potential in the VUV and UV regions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0018, NUCLEAR PHYSICS PROGRAM

H.G. BLOSSER, Michigan State University, School of Natural Sciences, *East Lansing, Michigan* 48824 (PHY78-01684)

This grant will provide continuation of support for the nuclear physics research at Michigan State University and for studies in cyclotron design and related topics presently supported under NSF grant PHY76-02206 AO3. This program has centered around a sector focussed cyclotron which was designed and built at Michigan State with assistance provided orginally by NSF grant GP-19978. A multifaceted research program in many areas of nuclear science, and ranging from nuclear astrophysics to magnet design, is carried out by experimental and theoretical nuclear physicists, nuclear chemists, and accelerator scientists.

A broad range of topics in nuclear physics, nuclear instrumentation, accelerator physics, and theoretical physics will be carried out. The nuclear physics topics can be treated under five main headings: Studies Related to Nuclear Isospin; Experiments Related to Astrophysics; Reaction Mechanisms and Average Nuclear Properties; Nuclear Spectroscopy with Direct Reactions; and Beta and Gamma Ray Spectroscopy. Studies of inelastic scattering, giant resonances, and charge dependent effects as well as a substantial program of shell-model calculations will be carried out.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0019, RAMAN SCATTERING STUDIES OF ION-IMPLANTED SILICON CARBIDE AND P-TYPE SILICON CARBIDE

P.J. COLWELL, Michigan State University, School of Natural Sciences, *East Lansing, Michigan* 48824 (DMR76-81842)

The research supported by this grant will include vibrational Raman scattering studies of ion-implanted semiconductors to determine the lattice location of the implanted species, and to characterize the nature of the implantation-induced lattice damage. Initially, silicon carbide which has been bombarded with H ion, D ion, and He ion will be studied.

Also, electronic Raman scattering studies of either heavily or lightly doped p-type semiconductors will be performed, in order to obtain information about the valence bands, and, for lightly doped p-typed semiconductors, to study several unexplained features of acceptor Raman spectra. Initially boron- and aluminum-doped silicon carbide will be studied.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0020, THERMALLY STIMULATED CURRENTS IN ALKALI-CONTAINING GLASSES

D.E. DAY, Univ. of Missouri, Center for Mat. Research, *Rolla, Missouri* 65401 (DMR77-13002)

This research will be an investigation of the storage and motion of electrical charge (polarization and conductivity) in alkali silicate glasses using thermally stimulated current (TSC) and ionic thermal current (ITC) techniques in order to obtain information about the nature of the alkali sites in vitreous solids. The study will investigate the localized sodium (Na) motion recently observed in a sodium silicate glass with these techniques, and which is currently attributed to the trapping of Na ions at the interface of immiscible phases, interfacial polarization, and to Na ion motion around the non-bridging oxygen ions, Na ion-(NBO)anion dipole polarization. The dependence of the parameters for this localized motion upon both glass composition and microstructure will be determined in order to evaluate those characteristics of the local alkali ion environment and glass microstructure which control short-range, and consequently, long-range alkali motion.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0021, LARGE AMPLITUDE ION ACOUSTIC WAVES ON THE BEAM PLASMA INSTABILITY

R.F. ELLIS, Dartmouth College, School of Arts & Sciences, *Hanover, New Hampshire* 03755 (DF049590; AF-AFOSR-3410-77)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand advanced equipment unavailable to date. Deficiency - present-day information is inadequate to design the aforementioned equipment. Such information may be obtained from experimental and theoretical work on beam-plasma nonlinear interactions. Objective - this project will investigate the effects of large amplitude ion acoustic waves on the beam-plasma instability. Contribution - this work is a part of a comprehensive program on plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications and the development of countermeasures.

This project will perform experiments on a fast electron beam which is propagated in a plasma containing large-amplitude short-wavelength ion-acoustic waves. In these experiments the following processes appear: (a) the beam drives a long-wavelength plasma wave unstable, (b) this wave couples its energy strongly to a much shorter wavelength plasma wave. From the foregoing it is expected to isolate the effect of large-amplitude ion acoustic waves upon the beam-plasma instability. The procedure will be as follows - the beam plasma instability will be studied both with and without the externally generated ion waves. The growth and saturation of the instability will be measured with probes. The energy distribution of the plasma and the beam will be measured with gridded energy analyzers. According to theory it is expected that the ion waves will produce a reduction in the saturation level of the primary beam-plasma wave, large electron wave sidebands and enhancement of the energy transferred to plasma particles. A wide range of plasma beams and wave parameters will be studied to understand the coupling of energy from one frequency plasma wave to another. These measurements will be made for both coherent ion waves and turbulent ion waves.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0022, MATERIAL SUPPORT TECHNOLOGY - RESEARCH ON CHALCOPYRITE SEMICONDUCTORS

G.B. WRIGHT, Stevens Institute of Technol., School of Engineering, *Hoboken, New Jersey* 07030 (DN675171; N00014-76-C-0384)

To study the electronic and optical properties of those semiconducting compounds crystallizing in the chalcopyrite structure which are ternary analogs of the III-V and II-VI compounds to ascertain the possible applicability of these materials for use in naval electronic and optical systems.

Theoretical calculations of the electron energy bands will concentrate on the differing influence of these effects: the change in the chemical potential of the a-b cation sublattices in perturbation from III-V or II-VI lattices, the effect of the c/a distortion, and the effect of the anion distortion. This study will utilize a blend of symmetry, pseudopotential, deformation potential, and k-p techniques. Experiments will utilize piezo-spectroscopy to ascertain deformation potentials and optical pumping luminescence measurements to ascertain g-factors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0023, MATERIAL SUPPORT TECHNOLOGY - PIEZO-OPTICAL DETERMINATION OF DEFORMATION POTENTIALS IN MULTI-VALLEYED SEMICONDUCTORS

F.H. POLLAK, Yeshiva University, School of Science, *New York, New York* 10033 (DN675243; N00014-76-C-0481)

Calculations of the properties of new semiconductor materials for use in electronic devices that find application in naval systems rely upon a number of material constants, many of which are unknown and difficult to determine. This program will seek to ascertain various parameters that affect transport in semiconductors.

An investigation of the stress-dependence of the optical absorption will be carried out in several III-V semiconductors. Wavelength modulated transmission and reflection will be utilized to measure both indirect and direct transitions from valence to conduction band. From the transition rates and the scattering processes, the absolute values for the electron-phonon and hole-phonon deformation potentials for intervalley processes can be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0024, STUDY OF SECONDARY ELECTRONS FROM NEGATIVE ION COLLISIONS

J.S. RISLEY, Univ. of North Carolina, School of Math. & Phys. Scis., *Raleigh, North Carolina* 27607 (859)

This proposal is concerned with fundamental atomic collisions with negative ions. It is planned to study the distribution in energy of low-energy secondary electrons produced in single collisions of a negative ion (H-) with a single target atom; for example, Ar, Kr, and Xe. By measuring the intensity of certain lines associated with excited states of either the projectile negative ion or the target negative, it is anticipated that a better understanding will result in how energy (or electrons) is shared in slow collisions of highly correlated atomic systems.

SUPPORTED BY North Carolina State Government

8.0025, LASER RAMAN COMBUSTION DIAGNOSTIC TOOL

P. YANEY, Univ. of Dayton, School of Arts & Sciences, *Dayton, Ohio* 45469 (DF459540; F33615-76-C-2078)

To determine pattern factors at the exit of a jet engine combustor using laser Raman scattering.

A laser Raman system will be modified and then used to measure temperature and specie concentration profiles at the exit of a T56 jet engine combustor. The tests will be performed in a combustor rig facility. Profile data will be collected at a varity of different combustion conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aeropropulsion Lab.

8.0026, GAAS MATERIALS GROWTH AND PROCESSING

D.W. SHAW, Texas Instruments Incorporated, *Dallas, Texas* 75222 (DF040320; F44620-75-C-0036)

AF function - microwave electronic devices are essential components of Air Force communications, reconnaissance, surveillance, and countermeasures systems. Deficiency - the frequency capabilities of present-day solid-state devices are limited by the quality of the epitaxial material and the ability to process this material into precisely defined geometries. These

higher frequency requirements of greater epitaxial control (especially thickness) and greater fineness of device geometry are not being met by current techniques. Objective - it is the objective of this research to demonstrate greater control over epitaxial layer thickness and doping profile by using vapor phase epitaxy of GaAs at extremely low temperatures. In addition, a further objective is to achieve an understanding of various etchants which will ultimately determine the geometry of devices fabricated from epitaxial material. How work contributes - this work will contribute to the field of solid-state microwave devices by advancing the state of the art in GaAs materials processing beyond the frequency limits imposed by current techniques.

Complex GaAs epitaxial structures will be grown at subnormal and conventional temperatures and then a comparison will be made of the physical and electrical properties as well as the abruptness of the doping level at interfaces. The feasibility of growth of buffer layers suitable for FET structure will be assessed and the electrical properties of these layers will be characterized by capacitance-voltage and Hall effects measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0027, LOW-ALTITUDE PLASMA INSTRUMENT FOR DYNAMIC EXPLORER
UNKNOWN, Univ. of Texas, Graduate School, *Dallas, Texas* 75230 (NAS 5-24299)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0028, MESONIC ATOMS AT LAMPF
R. KUNSELMAN, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (EY-76-S-02-2197)

Muonic and pionic atom measurements will be continued at LAMPF. The muonic and pionic measurements should complement each other both with nuclear structure measurements and with QED tests. The muon is an almost purely electromagnetic probe, whereas the pion is a strong interaction probe as well as electromagnetic. Any discrepancy in energy observed with muons can be checked by a measurement with pions. At present, as the beam is improving, we plan to continue analysis of the available data as well as a few conventional measurements on distorted nuclei. It is hoped a not much used test beam can be improved into a more useful experimental beam.

Antiprotonic X rays in hydrogen at BNL will be looked for to study the basic interaction of antiprotons with protons. The measurements should yield the low-energy scattering length or phase shift. The X rays from sigma-minus atoms should yield a better value of the magnetic moment when the more intense stopping beam becomes available.

RESULTS: The results from LAMPF include some determinations of nuclear charge distribution (Q zero, pi zero) of high atomic number distorted nuclei. The results from BNL include determinations of some strong interaction effects in high atomic number p atoms and a measurement of the p mass.

Part 2 Of 2.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, NON-CONTACT SUSPENSION/PROPULSION TECHNOLOGIES
J.L. MILNER, Mitre Corporation, *McLean, Virginia* 22101 (148334 (HRB NO.))

An integrated magnetic levitation/propulsion system is a possible candidate for achieving noiseless, lightweight urban and moderate speed interurban transportation. The objective of this research is to explore the feasibilty of such systems for high-speed interurban transportation. A single-sided linear induction motor (LIM) and reaction rail will be fabricated and tested on the rotating wheel facility operated by the Canadian Institute of Guided Ground Ground Transport at Queens University in Kingston, Ontario. These tests and subsequent analysis will be used to place SLIM performance in context with competing magnetic levitation schemes.

SUPPORTED BY U.S. Dept. of Transportation, Urban Mass Transportation Admin.

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, NAVIGATION--STELLAR PHOTOMETRY
C.C. DAHN, U.S. Navy, Observatory, *Flagstaff, Arizona* 86001 (DN046004)

Brightnesses and colors of selected stars are used in the Time Observation Program and the Fundamental Star Position Program in which the Naval Observatory has a Department of Defense-directed requirement.

Observations are carried out with the Naval Observatory's 61-inch and 40-inch reflectors located at the Flagstaff station in Arizona, using special Naval Observatory-developed equipment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Observatory

10.0002, EVALUATION AND IMPROVEMENT OF ACTIVE OPTICS ELEMENT IN A LARGE MULTIPLEMIRROR TELESCOPE
W.F. HOFFMANN, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (AST76-20822 A01)

A multiple-mirror telescope on Mount Hopkins, a 8,650 foot mountain south of Tucson, Arizona, is in the final stages of construction. It has been funded by the University of Arizona and the Smithsonian Astrophysical Observatory. It is equivalent to a conventional telescope 4.5 meters in diameter but uses six 1.8 meter diameter mirrors working together. The crucial element is the active optics control system which combines the beams from all six mirrors, continually adjusting each one to maintain optimum alignment.

A three-year program of testing and evaluation of the active optics system will be carried out at the University of Arizona. The performance of the optical system will be critically evaluated. The system will be improved wherever possible. The limiting factors in the telescope mechanics and in the earth's atmosphere will be identified. The results will be analyzed with respect to the application of the multi-mirror approach for the construction of new very large aperture optical and infrared telescopes.

This is a continuation of research previously funded under NSF Grant AST 76-20822.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, A MILLIMETER-WAVE INTERFEROMETER AND A SUB-MILLIMETER RADIOMETRIC TELESCOPE
R.B. LEIGHTON, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST76-13334 A01)

A millimeter-wave interferometer will be built and integrated into the operation of the Owens Valley Radio Observatory of Cal Tech. Accompanying the interferometer will be an ultra-precise 10 meter diameter radiometric telescope for use at wavelengths as short as 350 microns - a factor of seven improvement over current 10 meter diameter telescopes. The interferometer will consist of three 10-meter diameter telescopes separated by up to one kilometer. This gives an effective resolving power of 0.2 seconds of arc at a wavelength of one millimeter. The ability to see such fine details is needed in the studies of: Protostars in the process of collapse; The distribution of molecules in the interstellar medium; The thermal radiation from planets and satellites in the solar system; The distribution of molecules and isotopes in other galaxies; The lower levels of the solar atmosphere where solar flares occur.

This is a continuation of research previously supported by NSF Grant AST 76-13334.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, IONIZED GAS IN NEBULAE, GALAXIES, AND QUASARS
D.E. OSTERBROCK, Univ. of California, Lick Observatory, *Santa Cruz, California* 95060 (AST76-18440 A01)

Seyfert galaxies and radio galaxies, star systems in which large amounts of energy are released, will be studied spectroscopically using the Lick Observatory 120-inch telescope. Accurate quantitative spectra will be taken of these objects and analyzed to try to learn about the physical conditions, how the large velocities of the gas observed in these objects are maintained, and how the energy that makes them radiate light is fed into the gas. The measurements made with the spectral scanner on the telescope will be compared with theoretical calculations in an effort to test our ideas and, if possible, to find out observationally which of them can be narrowed down and better specified, and which can be eliminated from consideration. A more definite picture of the energy sources in galaxies will emerge.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, STELLAR STRUCTURE AND EVOLUTION
J.P. COX, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (AST77-23182)

Studies of problems in basic stellar structure and evolution will be continued. Emphasis will be mainly on the radial and non-radial stability of stars in various stages of evolution using fully non-adiabatic methods of analysis. Associated investigations will include some effects of rotation and the coupling of modes of oscillation. In addition, some areas of high-energy astrophysics will be explored, namely the transport of X-rays in energy and space through circumstellar gas. The program in experimental nuclear astrophysics will be continued to include study of helium-induced reactions.

Prior support was by NSF grant AST 72-05039 A04.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, RESEARCH ON EXTRAGALACTIC ASTRONOMY
H. ARP, Carnegie Inst. of Washington, *Washington, District of Columbia* 20005 (INT77-12567)

This project is the proposed continuation of work between the Assiago Observatory in Italy and the Palomar Observatory in the United States in galactic and extragalactic astronomy. Specifically, the cooperative effort is aimed at research about galaxies which are physically associated companions of bright spiral galaxies. The investigators are combining photometric, spectroscopic, and photographic observations. The objective is to determine if there are distinctive physical characteristics of the companion galaxies which could give clues as to their origin and evolution. Previous award, INT7411814.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

10.0007, SPACE RESEARCH TECHNOLOGY
T.A. CHUBB, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN320221)

To develop and construct demonstration devices of value to the Navy and DoD based on technology developed for the rocket program, e.g., IR, visible and UV surveillance sensors based on image converters and solid-state arrays used in space astronomy. To develop devices needed for the NRL rocket and satellite program, position determining X-ray sensors, band sensitive optical detectors, thick film electronic packaging techniques and counter-shift register circuitry, telemetry decoding systems and computer data interfaces.

Image converter designs developed in the far UV astronomy program are adapted to other spectral bands. Proportional counter arrays are constructed and electronically interfaced to provide x-y photon location. High gain point anode proportional counters and trigger circuits are developed for single photon counting in the UV. Resonant spacial IR choppers are developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

10.0008, DEVELOPMENT OF IMPROVED PLANETARY AND SATELLITE MOTIONS
P.K. SEIDELMANN, U.S. Navy, Observatory, *Washington, District of Columbia* 20390 (DN546002)

Support and augment the technical/operational programs and activities of the Naval Observatory in accordance with its Navy and Department of Defense mission of navigation and time determination of studying the motions of the planets and satellites to improve the accuracy of their calculated positions at past and future times. These theories are basic to the navigational tables and almanacs used for surface, air and space navigation.

Construct mathematical theories of the motions of the planets and satellites, compare these motions with observations, determine constants for the theories and other astronomical constants, and adapt the theories to practical use. Ephemerides of planet and satellite positions are computed based on these improved theories.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Observatory

10.0009, STUDIES OF EXTENDED AND EXPANDING STELLAR ATMOSPHERES
J.P. CASSINELLI, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (AST76-15448 A01)

The structure of the atmospheres of hot stars which show spectral evidence of geometrical extension, expansion, and rotational distortion will be studied. The investigation will be composed of three related parts: (1) A theory of the star's corona and of a stellar wind driven by radiation pressure will be developed in order to explain the observed rise in temperature in the outer layers of hot stars. (2) An analysis of the continuous energy distribution in the atmosphere will be made in order to determine the structure of the atmosphere. (3) There will be a further development of rotationally distorted stellar atmospheres in order to study methods for probing the density structure of early-type stellar atmospheres.

This is a continuation of research previously supported by NSF grant AST76-15448.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

GENERAL

11.0001, AN EVALUATION OF AUDIO AND VIDEO TELECONFERENCING TECHNIQUES AND USAGE
R. COMPESI, Calif. State Univ. & Colleges, Graduate School, *San Francisco, California* 94132 (NCA 2-660803)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

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01 AERONAUTICS (GENERAL)

N78-22019* + National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 94, MAY 1978
Mar. 1978 119 p
(NASA-SP-7037(94)) Avail: NTIS E02 CSCL 01A

This bibliography lists 407 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1978. Author

N78-22020*# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
A MAINTENANCE MODEL FOR K-OUT-OF-N SUBSYSTEMS ABOARD A FLEET OF ADVANCED COMMERCIAL AIRCRAFT
Douglas R. Miller Mar. 1978 65 p refs
(Grant NsG-1338)
(NASA-CR-145272; TM-66502) Avail: NTIS HC A04/MF A01 CSCL 05A

Proposed highly reliable fault-tolerant reconfigurable digital control systems for a future generation of commercial aircraft consist of several k-out-of-n subsystems. Each of these flight-critical subsystems will consist of n identical components, k of which must be functioning properly in order for the aircraft to be dispatched. Failed components are recoverable; they are repaired in a shop. Spares are inventoried at a main base where they may be substituted for failed components on planes during layovers. Penalties are assessed when failure of a k-out-of-n subsystem causes a dispatch cancellation or delay. A maintenance model for a fleet of aircraft with such control systems is presented. The goals are to demonstrate economic feasibility and to optimize. Author

N78-22021# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
IMPROVING READINESS: A COST-EFFECTIVE APPROACH M.S. Thesis
David Dean Dawson Dec. 1977 105 p refs
(AD-A050765; AFIT/GOR/SM/77D-4) Avail: NTIS HC A06/MF A01 CSCL 14/1

This thesis develops and demonstrates a method for improving aircraft readiness by adding specific stocks to specific bases. The effect of additional stockage on Not Operationally Ready Supply (NORS) is discussed. The relationship of items requisitioned as NORS to NORS aircraft is investigated using eight months of reported NORS for the A7D. Using an expression for expected NORS which is developed in the paper, a method for improving readiness is presented. The potential of the method is demonstrated using data on the F111, FB111, A7D, and B52. Increases in readiness equivalent to several additional aircraft are shown to be possible for relatively very low investments. A summary of eight months of NORS data for the F111, FB111, A7D, B52 and C135 is also included. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-22022 Illinois Univ., Urbana-Champaign.
BASE PRESSURE PROBLEMS ASSOCIATED WITH AN AXISYMMETRIC TRANSONIC FLOW PAST A BACKWARD FACING STEP Ph.D. Thesis
Jim Sheau-Kung Liu 1977 110 p
Avail: Univ. Microfilms Order No. 78-04072

The overall flow pattern of this problem was established as a result of interaction between the viscid and inviscid streams and the solutions can be obtained by simultaneously considering the influence from both streams. The basic idea employed in this analysis is to interpret the inviscid flow field as if it were produced for an equivalent inviscid body whose geometrical description relies upon some characteristic parameters, and the correct values of these parameters are to be determined through the viscous flow analysis. Inviscid flow field was established from solving the full axisymmetric potential equation by the numerical method of relaxation and the viscous flow is studied by an integral method. Dissert. Abstr.

N78-22023 Iowa State Univ. of Science and Technology, Ames.
COMPUTATION OF THE INVISCID SUPERSONIC FLOW ABOUT CONES AT LARGE ANGLES OF ATTACK BY A FLOAT DISCONTINUITY APPROACH Ph.D. Thesis
James Edward Daywitt 1977 93 p
Avail: Univ. Microfilms Order No. 78-05929

The technique of floating shock fitting was adapted to the computation of the inviscid flowfield about circular cones in a supersonic free stream of angles of attack that exceed the cone half-angle. In those regions in which the governing conical equations were mixed elliptic-hyperbolic, the fully hyperbolic form was obtained by the addition of the temporal derivative. The resulting equations were applicable over the complete range of free-stream Mach numbers, angles of attack, and cone half angles for which the bow shock was attached. An explicit finite difference algorithm was used to obtain the solution by an unsteady relaxation approach. The bow shock, embedded crossflow shock and vortical singularity in the leeward symmetry plane were all treated as floating discontinuities in a fixed computational mesh.
Dissert. Abstr.

N78-22024 Auburn Univ., Ala.
A NUMERICAL METHOD FOR SOLVING THE FULL POTENTIAL EQUATION Ph.D. Thesis
James Wayne Purvis 1977 73 p
Avail: Univ. Microfilms Order No. 78-06096

A computational method is presented for the analysis of steady, adiabatic, inviscid flow over two dimensional and three dimensional axisymmetric bodies. A unique formulation of the full potential equation was developed in the analysis. The numerical method blended finite element and finite difference concepts into an iterative procedure with rapid convergence properties. Numerical results at high subsonic Mach numbers were compared with experimental data and results of other methods. Agreement between theory and experiment was excellent. Computational advantages and capabilities of the numerical method are discussed. Dissert. Abstr.

N78-22025*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A 0.08-SCALE YF-17 AIRPLANE MODEL AT HIGH ANGLES OF ATTACK AND SIDESLIP

Daniel N. Petroff, Stanley H. Scher, and Carl E. Sutton (ARO, Inc., Moffett Field, Calif.) Apr. 1978 118 p refs
(NASA-TM-78438; A-7214) Avail: NTIS HC A06/MF A01 CSCL 01A

Data were obtained with and without the nose boom and with several strake configurations; also, data were obtained for various control surface deflections. Analysis of the results revealed that selected strake configurations adequately provided low Reynolds number simulation of the high Reynolds number characteristics. The addition of the boom in general tended to reduce the Reynolds number effects. Author

N78-22026*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

SYSTEM AND METHOD FOR REFURBISHING AND PROCESSING PARACHUTES Patent Application

Russell T. Crowell, inventor (to NASA) Filed 21 Dec. 1977 19 p
(NASA-Case-KSG-11042-1; US-Patent-Appl-SN-862878) Avail: NTIS HC A02/MF A01 CSCL 13H

A system and method for refurbishing and processing parachutes is described. An overhead monorail conveyor system on which the parachute is suspended for horizontal conveyance is also included. The parachute is first suspended in partially open tented configuration wherein open inspection of the canopy is permitted to remove debris and inspect all areas. Following inspection, the parachute is transported by the monorail conveyor to a washing and drying station with the parachute canopy mounted on the conveyor in a systematic arrangement which permits water and air to pass through the ribbon like material of the canopy. Following drying of the parachute, the chute is conveyed into an interior space where it is finally inspected and removed from the monorail conveyor and laid upon a table for folding. Following folding operations, the chute is once again mounted on the conveyor in an elongated horizontal configuration and conveyed to a packing area for stowing the parachute in a deployment bag. NASA

N78-22027*# Stanford Univ., Calif. Thermosciences Div.

LARGE-EDDY SIMULATION OF A TURBULENT MIXING LAYER

N. N. Mansour, J. H. Ferziger, and W. C. Reynolds Apr. 1978 210 p refs
(Grant NGR-05-020-622)
(NASA-CR-156575; TF-11) Avail: NTIS HC A10/MF A01 CSCL 01A

The three dimensional, time dependent (incompressible) vorticity equations were used to simulate numerically the decay of isotropic box turbulence and time developing mixing layers. The vorticity equations were spatially filtered to define the large scale turbulence field, and the subgrid scale turbulence was modeled. A general method was developed to show numerical conservation of momentum, vorticity, and energy. The terms that arise from filtering the equations were treated (for both periodic boundary conditions and no stress boundary conditions) in a fast and accurate way by using fast Fourier transforms. Use of vorticity as the principal variable is shown to produce results equivalent to those obtained by use of the primitive variable equations. Author

N78-22028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF STORES ON LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A FIGHTER AT SUPERSONIC SPEEDS

Samuel M. Dollyhigh, Giuliana Sangiorgio, and William J. Monta Apr. 1978 46 p refs
(NASA-TP-1175; L-11874) Avail: NTIS HC A03/MF A01 CSCL 10C

Experimental investigations of single and twin stores representative of advanced, elliptical cross section missile concepts were made at Mach numbers from 1.60 to 2.16 to substantiate theoretically predicted results. The stores were mounted on the fuselage of a model representing a fighter configuration. Store base closure effects in the carriage condition were also obtained through tests with and without base closure fairings. Author

N78-22029# Toronto Univ. (Ontario).

PRESSURE INSIDE A ROOM SUBJECTED TO SONIC BOOM

Nabil N. Wahba May 1977 58 p refs
(UTIAS-TN-207; CN-ISSN-0082-5263) Avail: NTIS HC A04/MF A01

The pressure field inside a room subjected to sonic boom was investigated in order to study the problems of dynamic structural response and crack propagation. The data obtained ultimately may be useful for the assessment of structural damage caused by supersonic transport overflights. The problem of a room with an open window exposed to sonic boom was considered to be analogous to that of a Helmholtz resonator which is externally excited. The damping of the system was related to such physical quantities as the geometry of the room, the size of the open window and the average absorption coefficient of the interior surfaces of the room. An analytical method based on a Fourier transform was developed and used to study the effects of room volume, window area and type of N wave on the pressure time variations inside the room. Author

N78-22030# Illinois Univ., Urbana-Champaign. Dept. of Mechanical and Industrial Engineering.

BASE PRESSURE PROBLEMS ASSOCIATED WITH AN AXISYMMETRIC TRANSONIC FLOW PAST A BACKWARD FACING STEP

J. S. K. Liu and W. L. Chow Nov. 1977 108 p refs
(Grant DAAG29-76-G-0199)
(AD-A050658; ME-TR-395-5; UILU-eng-77-4013) Avail: NTIS HC A06/MF A01 CSCL 20/4

The base pressure problem of a transonic flow past a backward facing step in the axisymmetric configuration has been examined. The inviscid flow field is generated from an equivalent body with a characteristic parameter and the value of this parameter is determined through the viscous flow analysis. The full axisymmetric potential equation is solved by numerical relaxation while the viscous flow is analyzed through integral formulations. The point of reattachment behaves as a saddle point singularity. The base pressure results are in reasonable agreement with available experimental data. Author (GRA)

N78-22031# ARO, Inc., Arnold Air Force Station, Tenn.

UNSTEADY TRANSONIC FLOW OVER BLUNT AND POINTED BODIES OF REVOLUTION Final Report, 1 Jul. 1975 - 13 Apr. 1977

T. Hsieh Feb. 1978 50 p refs
(AD-A050709; ARO-PWT-TR-77-64; AEDC-TR-77-100) Avail: NTIS HC A03/MF A01 CSCL 20/4

A perturbation theory and numerical solution, based on the unsteady full potential equation, were developed to calculate the unsteady transonic flow field over blunt and pointed bodies of revolution, performing harmonic oscillatory motions at zero incidence. Calculations were performed for pulsatile oscillations for a hemisphere-cylinder and pitching oscillations for an ogive-cylinder, an ellipse-cylinder, a hemisphere-cylinder, and a parabolic arc nose. Comparison between theory and experiments was made for the surface pressure distribution at quasi-steady state and for the static and dynamic stability derivatives.
Author (GRA)

N78-22032# ARO, Inc., Arnold Air Force Station, Tenn.
A PARAMETRIC INVESTIGATION OF THE ANNULAR JET CONCEPT FOR OBTAINING AFTERBODY DRAG DATA AT TRANSONIC MACH NUMBERS Final Report, 4-12 Nov. 1976
Earl A. Price, Jr. AEDC Feb. 1978 177 p refs
(AD-A050891; ARO-PWT-TR-77-69; AEDC-TR-77-104) Avail: NTIS HC A09/MF A01 CSCL 20/4

A parametric experimental program was conducted at free-stream Mach numbers of 0.6, 0.9, and 1.2 to investigate the plume simulation characteristics of annular jets. Plume simulation evaluation was based upon comparisons of afterbody pressure drag from integration of afterbody pressure measurements. Data were obtained on a 15 deg boattail afterbody attached to a strut supported cylindrical centerbody. Geometric variables covered a range of sting-to-nozzle exit diameter ratios from 0 to 0.95 and nozzle area ratios from 1.0 to 1.5. High pressure air at ambient temperature was utilized for the exhaust gas. The results indicate that matching of the exhaust plume maximum diameter provides a reasonable afterbody drag correlation, accounting for effects of annular jet, nozzle exit-to-throat area ratio, and nozzle pressure ratio for conditions where drag follows the classical trend indicative of a plume shape dependence. Plume diameter correlation was not successful, for the pressure ratios of this investigation, for annular jet configurations having sting-to-nozzle exit diameter ratios of 0.95 at all Mach numbers and 0.866 at Mach number 1.2. There were no significant differences in the trends with angle of attack between the annular and conventional jet configurations over the angle of attack range from -2 to 6 deg. Author (GRA)

N78-22033# Advisory Group for Aerospace Research and Development, Paris (France).
UNSTEADY AERODYNAMICS
Feb. 1978 609 p refs In ENGLISH; partly in FRENCH Presented at the Fluid Dyn. Panel Symp., Ottawa, 26-28 Sep. 1977
(AGARD-CP-227; ISBN-92-835-0212-4) Avail: NTIS HC A99/MF A01

The effects of unsteadiness on the aerodynamic characteristics of lifting surfaces and bodies are discussed. Numerical analysis of three dimensional flow is emphasized. For individual titles, see N78-22034 through N78-22067.

N78-22034# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
UNSTEADY SUBSONIC AND SUPERSONIC INVISCID-FLOW
Holt Ashley *In* AGARD Unsteady Aerodyn. Feb. 1978 32 p refs (For availability see N78-22033 13-02)
(Grant AF-AFOSR-2712-74)
Avail: NTIS HC A99/MF A01

Circumstances under which the neglect of viscosity still yields useful results in the analysis of time-dependent airflows external to shapes of aeronautical interest are discussed. The corresponding physical laws are reduced to a single differential equation which governs the velocity potential. Determinate mathematical problem statements capable of predicting aerodynamic loads to first or second order in small disturbances superimposed upon a uniform airstream are summarized. Arbitrary small motions are emphasized. From fully linearized potential theory, information is reviewed on isolated lifting surfaces, slender bodies, and interfering configurations in flight below and above the ambient speed of sound. The sonic limit of linearized theory is assessed. The findings of comparative studies on selected wing planforms and on interfering systems are recalled. A brief discussion is presented on the progress of second-order approximations, such as local linearization and numerical solution of the field differential equations. Finally, speculations are offered about the increasing significance of numerical fluid dynamics as a practical approach to unsteady flow phenomena. Author

N78-22035*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
THREE DIMENSIONAL STEADY AND UNSTEADY ASYMMETRIC FLOW PAST WINGS OF ARBITRARY PLANFORMS
O. A. Kandil, E. H. Atta, and A. H. Nayfeh *In* AGARD Unsteady Aerodyn. Feb. 1978 19 p refs (For availability see N78-22033 13-02)
(Grant NGR-47-004-090)
Avail: NTIS HC A99/MF A01

The nonlinear discrete vortex method is extended to treat the problem of asymmetric flows past a wing with leading edge separation, including steady and unsteady flows. The problem is formulated in terms of a body fixed frame of reference and the nonlinear-discrete vortex method is modified accordingly. Although the method is general, only examples of flows past delta wings are presented due to the availability of experimental data as well as approximate theories. Comparison of results with experimental results for a delta wing undergoing a steady rolling motion at zero angle of attack demonstrate the superiority of the present method over existing approximate theories in obtaining highly accurate loads. Numerical results for yawed wings at large angles of attack are also presented. In all cases, total load coefficients, pressure distributions, and shapes of the free vortex sheets are shown. Author

N78-22036*# Boston Univ., Mass. Dept. of Aerospace and Mechanical Engineering.
STEADY, OSCILLATORY AND UNSTEADY, SUBSONIC AND SUPERSONIC AERODYNAMICS (SOUSSA) FOR COMPLEX AIRCRAFT CONFIGURATIONS
Luigi Morino and Kadin Tseng *In* AGARD Unsteady Aerodyn. Feb. 1978 14 p refs (For availability see N78-22033 13-02)
(Grant NGR-22-004-030)
Avail: NTIS HC A99/MF A01

The Green's function method and the computer program SOUSSA (Steady Oscillatory and Unsteady Subsonic and Supersonic Aerodynamics) are reviewed. The Green's function method is applied to the fully unsteady potential equation yielding an integro-differential-delay equation. This equation is approximated by a set of differential-delay equations in time using the finite element method. The Laplace transform is used to yield a matrix relating the velocity potential to the normal wash. The matrix of the generalized aerodynamic forces is obtained by premultiplying and postmultiplying the matrices relating generalized forces to the potential and the normal wash by the generalized coordinates. The program SOUSSA is compared with existing numerical results. Results indicate that the program is not only general, flexible, and easy to use, but also accurate and fast. Author

N78-22037# University Coll., London (England). Dept. of Mechanical Engineering.
FORCE MEASUREMENTS ON FINITE WINGS IN OSCILLATORY VERTICAL GUSTS
M. H. Patel *In* AGARD Unsteady Aerodyn. Feb. 1978 16 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

Aerodynamic lift and pitching moment measurements on two finite wings in harmonic vertical oscillatory gusts of varying frequency parameter and gust amplitude are described. The variation of aerodynamic force per unit gust amplitude with frequency parameter is shown to be independent of freestream velocity, wing incidence, and gust amplitude, but is strongly influenced by wing sweep. The tests on both wings are extended to the determination of aerodynamic force response to periodic vertical gusts which incorporate a combination of two harmonic frequency components. The validity of the superposition concept for unsteady attached flow over finite wings is demonstrated by comparing the components of force response at each of the two forcing frequencies to the corresponding response at the single harmonic frequency. Further measurements of lift, pitching moment, and rolling moment are presented for both wings at various attitudes of skew (in yaw) to a harmonic oscillatory gust front. The effects of the resultant asymmetric lift distribution on the two wings halves are identified in the results with particular reference to the amplitudes and phases of oscillating rolling moments that are generated. Author

N78-22038# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
CALCULATION OF UNSTEADY AIRLOADS ON OSCILLATING THREE-DIMENSIONAL WINGS AND BODIES
Wolfgang Geissler *In* AGARD Unsteady Aerodyn. Feb. 1978

13 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

A numerical method developed to calculate the steady and unsteady pressure distributions on harmonically oscillating three dimensional wings and bodies in subsonic flow is described. The method is based on a complex velocity potential represented by appropriate singularity distributions on the real oscillating surfaces. The exact geometric boundary condition on the arbitrary body surface is considered. Oscillating three dimensional thin wings, oscillating bodies at incidence, and oscillating three dimensional wings with finite thickness and incidence were investigated intensively. Numerical results for a variety of problems were compared to other analytical methods as well as experimental data. Agreement was found to be satisfactory. Author

N78-22039# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.

SOME BASIC AND NEW ASPECTS ON THE DISTURBANCE FIELDS OF UNSTEADY SINGULARITIES IN UNIFORM MOTION

Arabindo Das *In* AGARD Unsteady Aerodyn. Feb. 1978 31 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

The influence factors arising from the motion of unsteady singularities and generally valid expressions for these effects are considered. In the linearized theory the aerodynamic and aeroacoustic problem are dealt with by means of a unified treatment. The derived expressions for the influence factors are given general forms which are uniformly valid for subsonic and supersonic velocities of the singularities. The unsteady singularities which are commonly encountered in the field of aerodynamics and aeroacoustics are represented as sources, dipoles, and quadrupoles. The expressions for the near field and far field disturbances of the various moving singularities are presented. The resulting changes in the disturbance fields of moving singularities compared to those of space fixed singularities in an unbounded medium at rest may be denoted as Mach number effect. The usual global notation of this effect as compressibility effect is neither true nor applicable, when linearized theory of disturbance fields is considered. Finally, the problem of disturbance propagation from singularities in motion is treated in a moving reference frame by applying the Lorentz transformation in a nondimensional form, which preserves the physical quantities defined in the medium fixed system, much as singularity strength, phase relations, etc. The significance of the Lorentz transformation is elucidated by presenting the field of a moving source in the space-time continuum. Author

N78-22040# Fuehrungsakademie der Bundeswehr, Hamburg (West Germany).

INTERFERING AIRFOILS IN TWO-DIMENSIONAL UNSTEADY INCOMPRESSIBLE FLOW

Helmut Bosch *In* AGARD Unsteady Aerodyn. Feb. 1978 15 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

The interference of two or more lifting surfaces in two dimensional unsteady incompressible flow is considered. The integral relations relating the unsteady flow components around a harmonically oscillating airfoil to the pressure distribution are presented. These relations are then applied to treat two problems: first, calculation of the flow field around a single airfoil for a given pressure distribution and, second, calculation of the aerodynamic forces acting on the lifting surfaces. Special consideration is given to the longitudinal force component, i.e. drag or propulsion, acting on the lifting surfaces, and to the propulsion efficiency. The results show that for both the plunging motion and the pitching motion, a lifting surface at rest located behind an oscillating airfoil considerably improves the propulsion efficiency. For the plunging motion the propulsion efficiency is very close to 100%, almost independent of the reduced frequency and the backward position of the aft surface. Author

N78-22041# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

STUDY OF A SUPERCRITICAL PROFILE WITH OSCILLATING CONTROL SURFACE IN SUB- AND TRANSONIC FLOWS

Richard Grenon and Jean Thers *In* AGARD Unsteady Aerodyn. Feb. 1978 10 p refs In FRENCH; ENGLISH summary (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

Results of unsteady pressure measurements performed on a supercritical profile equipped with a 25% churd trailing edge control surface in harmonic motion, in two dimensional sub- and transonic flows are presented. Important differences appeared between the subcritical regime without shock, and the supercritical regime with shock. In both cases, the influence of the unsteady parameters, such as oscillation frequency and amplitude, and that of steady ones, such as mean flap setting and wing angle of attack is considered. The importance of viscous and shock related phenomena, and the necessity to develop calculation methods taking these phenomena into account is emphasized. Author

N78-22042# National Aerospace Lab., Amsterdam (Netherlands).

INVESTIGATION OF THE UNSTEADY AIRLOADS ON WING-STORE CONFIGURATIONS IN SUBSONIC FLOW

J. W. G. VanNunen, R. Roos, and J. J. Meijer *In* AGARD Unsteady Aerodyn. Feb. 1978 10 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

The unsteady aerodynamic loading on oscillating wing-store configurations is considered. Accurate prediction of the unsteady airforces introduced by wing mounted stores is emphasized. Author

N78-22043# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.

UNSTEADY TRANSONIC FLOW COMPUTATIONS

A. R. Seebass, N. J. Yu, and K. Y. Fung *In* AGARD Unsteady Aerodyn. Feb. 1978 17 p refs (For availability see N78-22033 13-02)
(Grant NsG-2112; Contract N00014-76-C-0182; Grant AF-AFOSR-2954B-76)
Avail: NTIS HC A99/MF A01

The effects of unsteady modes of motion on two dimensional transonic flows are described. The alternating direction implicit procedure is employed. Shock waves are treated as moving discontinuities. Results of nonlinear and time linearized calculations of the transonic flow past an NACA 64A006 airfoil experiencing harmonic motions in several of its modes are presented and discussed. Author

N78-22044# Northrop Corp., Hawthorne, Calif. Aircraft Div.

TOWARDS A MIXED KERNEL FUNCTION APPROACH FOR UNSTEADY TRANSONIC FLOW ANALYSIS

D. D. Liu and B. A. Winther *In* AGARD Unsteady Aerodyn. Feb. 1978 17 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

A new formulation in adopting multikernel functions, according to the mixed flow structure, for three dimensional analyses of the oscillatory transonic flow problems is proposed. It was aiming at a unified approach that would bridge the previous subsonic and supersonic lifting surface methods through the regime of linearized transonic flow. The analysis attempted to include the effect of the transonic shock wave; a mildly oscillatory shock-jump condition was derived and its compatible boundary condition considered. The only provision of the present approach was that the nonlinear mean flow distribution must be supplied by other experimental or theoretical means. Author

N78-22045# McDonnell-Douglas Research Labs., St. Louis, Mo.

UNSTEADY TRANSONIC FLOW IN A TWO-DIMENSIONAL DIFFUSER

M. Sajben, J. C. Kroutil, and C. P. Chen *In* AGARD Unsteady Aerodyn. Feb. 1978 14 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

Two dimensional diffuser flows, including a normal shock near the throat, were investigated using a model with a 2.36 exit to throat area ratio. Reynolds numbers based on the 48 mm throat height ranged to 100,000; the largest time-mean shock Mach number was 1.45. Extensive sidewall and corner boundary layer control produced reasonable two dimensionality of the time-mean flow. The flow was separated at all transonic conditions.

Observation and subsequent quantitative analysis of high speed schlieren films showed that the system exhibited low frequency fluctuations, highly correlated over the entire diffuser length.
Author

N78-22046# Informatics, Inc., Palo Alto, Calif.
UNSTEADY FORCE AND MOMENT ALLEVIATION IN TRANSONIC FLOW
W. Ballhaus (Ames Directorate, US Army AMRDL, Moffett Field, Calif.), P. Goorjian, and H. Ulshimra (Boeing Aerospace Co., Seattle) *In* AGARD Unsteady Aerodyn. Feb. 1978 10 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

In flutter suppression, controlled stability, and gust alleviation in a transonic regime, an understanding of how the unsteady lift and moment were generated is essential. Finite difference calculations based on 2D unsteady, small disturbance equations were first used to demonstrate the essential flow adjusting mechanisms. Based on this background, control devices situated in the sensitive parts of the airfoil were next investigated to moderate the chances in the lift and moment arising in the pitching oscillation of a NACA 64A-006 airfoil at M = 0.85.
Author

N78-22047# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INFLUENCE OF THE NOISE LEVEL IN A TRANSONIC WIND TUNNEL TEST SECTION ON THE AERODYNAMIC CHARACTERISTICS OF MODELS
Xavier Vaucheret *In* AGARD Unsteady Aerodyn. Feb. 1978 15 p refs In FRENCH; ENGLISH summary (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

This study was carried out with standard models. Except for a shift in the pitching moment, the noise does not affect the overall steady characteristics. Shock locations were strongly modified by the noise, but only when the separation occurs at the shock foot. Without separation, the edge tones were heard clearly by the pressure transducers, and even more so, as the lift decreases. With separation and suppression of wall noise, the transducers reveal wing vibrations on their natural modes.
Author

N78-22048# Virginia Polytechnic Inst. and State Univ., Blacksburg.
UNSTEADY BOUNDARY LAYERS, SEPARATED AND ATTACHED
Demetri P. Telionis *In* AGARD Unsteady Aerodyn. Feb. 1978 21 p refs (For availability see N78-22033 13-02) (Contract DAHC04-75-G-0067)
Avail: NTIS HC A99/MF A01

Ongoing research into unsteady boundary layers is reviewed, including laminar and turbulent fluctuating boundary layers. Unsteady separation and separated flows are also considered, along with the moving wall case.
J.A.M.

N78-22049# Centre d'Etudes et de Recherches, Toulouse (France).
EXPERIMENTAL RESULTS AND CALCULATING METHODS CONCERNING TRANSITIONAL AND TURBULENT BOUNDARY LAYERS IN UNSTEADY FLOW
Jean Cousteix, Robert Houdeville, and Andre Desopper *In* AGARD Unsteady Aerodyn. Feb. 1978 16 p refs In FRENCH; ENGLISH summary (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

A turbulent boundary layer developing in an oscillating external flow was studied experimentally. The periodic component and the turbulent fluctuation of the velocity were analyzed separately with statistical treatment of data from hot wire anemometers. A numerical method is presented for solving the local equations by using a mixing length scheme or a transport equation model.
Author

N78-22050# Sybucon, Inc., Atlanta, Ga.
UNSTEADY BOUNDARY LAYERS WITH REVERSAL AND SEPARATION
John F. Nash and Roy M. Scruggs *In* AGARD Unsteady Aerodyn. Feb. 1978 12 p (For availability see N78-22033 13-02) (Contract DAAG29-76-C-0045)
Avail: NTIS HC A99/MF A01

An appropriate computation scheme was developed for both laminar and turbulent flows, exploiting the validity of the first order theory. The effect of time dependence on flow reversal, the nature of unsteady reversal and separation, and the relevance of engineering results (notably to the dynamic stall problem) are discussed.
Author

N78-22051# Southern Methodist Univ., Dallas, Tex. Dept. of Civil and Mechanical Engineering.
FEATURES OF UNSTEADY TURBULENT BOUNDARY LAYERS AS REVEALED FROM EXPERIMENTS
R. L. Simpson *In* AGARD Unsteady Aerodyn. Feb. 1978 10 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

The first results from an experimental research program on unsteady turbulent boundary layers near separation are presented. The test flow is a periodic, nominally two dimensional, incompressible turbulent boundary layer on a flat surface. A programmable flow damper was used to produce the almost single harmonic velocity variation. It was found that the periodic flow in the viscous sublayer of the boundary is strongly influenced by the oscillating pressure gradient. Within the semilogarithmic velocity profile region there is no phase variation. Since the characteristic frequencies of the turbulence decrease markedly near preparation, there is much more interaction between the periodic oscillation and the turbulence in this region. Author

N78-22052# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.
AN EXPERIMENTAL STUDY OF THE EFFECT OF OSCILLATORY FLOW ON THE SEPARATION REGION IN A TURBULENT BOUNDARY LAYER
R. C. Kenison *In* AGARD Unsteady Aerodyn. Feb. 1978 12 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

A separated turbulent boundary layer on a plate was subjected to harmonic oscillations superimposed on the mean adverse freestream velocity distribution. The resulting effects were investigated over a range of frequencies up to 6 Hz and amplitudes up to 13 per cent of the mean freestream velocity. Measurements were made of boundary velocity profiles, turbulence components, static pressures and skin friction at various points along the plate surface before and immediately after the separation point. For the range of frequencies and amplitudes examined, the oscillating freestream had a negligible effect on the mean distributions of skin friction, static pressures, turbulence intensities, and the mean separation position. The variation of velocity amplitudes in the boundary layer, which exceeded the free stream amplitude at certain positions, was dependent on frequency and distance from the leading edge.
Author

N78-22053# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DYNAMIC STALL: AN EXAMPLE OF STRONG INTERACTION BETWEEN VISCOUS AND INVISCID FLOWS
Jean-Jacques Philippe *In* AGARD Unsteady Aerodyn. Feb. 1978 21 p refs In FRENCH; ENGLISH summary (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

The phenomena concerning profiles in dynamic stall configuration was surveyed, and more specifically those related to pitch oscillations. The most characteristic experimental results on flow separation with a vortex character, and their repercussions on local pressures and total forces were analyzed. Some aspects of the methods for predicting flows with the presence (or not) of boundary layer separation were examined, as well as the main simplified methods available to date for the calculation of total forces in such configurations.
Author

N78-22054# Illinois Inst. of Tech., Chicago. Dept. of Mechanics, Mechanical and Aerospace Engineering.
FEATURES OF UNSTEADY FLOWS OVER AIRFOILS
L. S. Gazana, A. A. Rejer, and M. V. Morkovin *In* AGARD Unsteady Aerodyn. Feb. 1978 11 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

Sinusoidally oscillating flows over stationary NACA 0012 airfoils were studied at angles of attack close to the angle of stall in steady flow by means of hot wire surveys of the velocity field, surface pressure measurements and diagnostics with surface film gages and tufts. At the moderate amplitude of these tests stall occurred at subcritical angle of attack and the flow was quasisteady below and above the angle when the frequency was low. At higher frequencies this quasisteady behavior persisted below subcritical angle of attack but the unsteadiness did alter some of the details of the flow. Author

N78-22055*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DYNAMIC STALL OF AN OSCILLATING AIRFOIL

Unmeel B. Mehta (Stanford Univ., Calif.) *In* AGARD Unsteady Aerodyn. Feb. 1978 32 p refs Sponsored in part by ARMDL (For availability see N78-22033 13-02)

(Contract NCA2-or745-602; Grant NSG-2253)

Avail: NTIS HC A99/MF A01 CSCL 01A

Unsteady separated boundary layers and wakes were studied by investigating flow past an oscillating airfoil which in part models the retreating blade stall on the helicopters. The Navier-Stokes equations in terms of the vorticity and stream function for laminar flow were solved to determine the flow field around a modified NACA 0012 airfoil. After a fully developed flow was determined at zero incidence, the airfoil was oscillated in pitch through an angle of attack range from 0 deg to 20 deg. The computed streamlines during this pitch-up motion are in qualitative agreement with the trajectories of air bubbles observed in water tunnel experiments conducted with a NACA 0012 airfoil under the same conditions. During the pitch-down motion of the airfoil, the computed flow patterns cannot be compared with the experiments because the trajectories of air bubbles intersect. Author

N78-22056# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

A NUMERICAL STUDY OF UNSTEADY VISCOUS FLOWS AROUND AIRFOILS

J. C. Wu, S. Sampath, and N. L. Senkar *In* AGARD Unsteady Aerodyn. Feb. 1978 18 p refs (For availability see N78-22033 13-02)

Avail: NTIS HC A99/MF A01

The application of an integro-differential approach in the numerical study of unsteady viscous flow about airfoils is described. Two different procedures are presented. A procedure based on a stream function vorticity formulation and on a transformation technique was in a study of flow about an impulsively started 9% thick Joukowaki airfoil at an angle of attack of 15 deg and a Reynolds number of 1000. Numerical results are presented and compared with available finite difference results. A second procedure based on a velocity vorticity formulation and on a hybrid finite difference-finite element technique is used in a study of flow about an oscillating 12% thick Joukowaki airfoil at a Reynolds number of 1000. With either procedure, the ability of the integro-differential approach to confine the solution field to the vertical region of the flow was utilized. It is shown that this ability offers great computational advantage. Author

N78-22057*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

SCALING PROBLEMS IN DYNAMIC TESTS OF AIRCRAFT-LIKE CONFIGURATIONS

Lars E. Ericson and J. Peter Reding *In* AGARD Unsteady Aerodyn. Feb. 1978 11 p refs (For availability see N78-22033 13-02)

(Contracts NAS8-28130; NAS8-30652)

Avail: NTIS HC A99/MF A01 CSCL 01C

To extrapolate from subscale wind tunnel tests to full scale flight is a well recognized problem. It is especially critical for present day high performance aircraft and the space shuttle orbiter which operate under flight conditions where separated flow effects often dominate the vehicle aerodynamics. In the case of dynamic tests it may not be possible to simulate flight conditions at subscale Reynolds number. This is illustrated by example from two dimensional dynamic stall tests at low speeds and dynamic tests of fully three dimensional configurations at transonic speeds, such as the space shuttle orbiter. It is shown how analytical means can be developed establishing theoretical relationships between dynamic and static aerodynamic characteristics and how such means make it possible to extrapolate analytically from subscale tests to full scale flight. The role of future high Reynolds number facilities in establishing such analytic extrapolation tools is discussed. Author

N78-22058# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).

TWO-DIMENSIONAL VISCOUS-FLOW PAST AN AIRFOIL IN AN UNSTEADY AIRSTREAM

Robert B. Kinney (Arizona Univ., Tucson) *In* AGARD Unsteady Aerodyn. Feb. 1978 14 p refs Sponsored in part by the Alexander von Humboldt Foundation (For availability see N78-22033 13-02)

Avail: NTIS HC A99/MF A01

Numerical predictions are made for the viscous flow field near an airfoil in an unsteady airstream of infinite extent. Using an extension of techniques familiar to ideal fluid aerodynamic analyses, the body is represented by bound vortex singularities. These coexist with the free vorticity, which forms the boundary layer and wakes. Application of the no-slip condition at the airfoil surface plus the law of conservation of total vorticity, allows the production of true vorticity at the airfoil surface to be modeled. The velocity field is calculated using the law of induced velocities. Results are presented for a symmetrical Joukowski airfoil of 9% thickness. The airfoil is held fixed, and initially the fluid is at rest. At some instant, the fluid is set into motion. Two cases are treated: the impulsive gust, and the periodic gust. Author

N78-22059# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DIFFICULTIES ENCOUNTERED BY AEROELASTICIANS OF UNSTEADY AERODYNAMICS

Rolland Dat and Jean-Jacques Angelini *In* AGARD Unsteady Aerodyn. Feb. 1978 12 p refs In FRENCH; ENGLISH summary (For availability see N78-22033 13-02)

Avail: NTIS HC A99/MF A01

The aeroelasticians have a real need of flexible and fast methods for calculating unsteady aerodynamic forces. The classical formulation based on the linear lifting surface theory is presented as an example of a method satisfactory as regards its domain of validity. The problems of supercritical flow and separation, which are much outside that domain, are unfortunately the most significant as far as flutter is concerned. Several experimental results are presented to show the phenomena particular to these flows. The approaches used to develop new methods are shown at the end. They extend from strict resolutions of the Mulerian equations to the development of corrections or phenomenological models. Author

N78-22060# Institut de Mecanique des Fluides de Lille (France).

THE STUDY OF SUBSONIC AND SUPERCRITICAL TURBULENT FLOWS BY ULTRA-SHORT DURATION VISUALIZATION [ETUDE D'ECOULEMENTS TURBULENTS SUBSONIQUES ET SUPERCRITIQUES PAR VISUALISATION ULTRA-RAPIDE]

A. Dyment and P. Gryson *In* AGARD Unsteady Aerodyn. Feb. 1978 29 p refs In FRENCH; ENGLISH summary (For availability see N78-22033 13-02)

Avail: NTIS HC A99/MF A01

The instability of the free boundary which follows separation is at the origin of large eddies existing downstream of a body in a flow. A general law is given which expresses the Strouhal number of eddies generated at a separation point as a function of the Reynolds number. The eddies undergo successive coalescences whose process is explained by a simplified theory. To form a vortex street whose Strouhal number is much lower than the emission one, the eddies of both sides have to coalesce again. The fact that the vortex street does appear immediately behind the body only at moderate Reynolds numbers can be explained in considering a relaxation time necessary for coalescing. Ultra-short duration shadowgraph and Schlieren visualizations were done with spark light sources. They give new information on the structure of the wake near the body in subsonic and supercritical flows. Author

N78-22061# Institut de Mecanique des Fluides de Marseille (France).
THE DYNAMIC FLOW ON A WING PROFILE IN THE MOVEMENT OF A SCREEN. THE INFLUENCE OF OSCILLATION PARAMETERS [RECOLLEMENT DYNAMIQUE SUR UN PROFIL D'AILE EN MOUVEMENT DE TAMIS INFLUENCE DES PARAMETRES D'OSCILLATION]
J. Rebont (CNRS, Marseilles (France)), C. Maresca (CNRS, Marseilles (France)), D. Favier (CNRS, Marseilles (France)), and J. Valensi (Aix-Marseilles Univ. (France)) *In* AGARD Unsteady Aerodyn. Feb. 1978 28 p refs In FRENCH (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

The mechanics of dynamic flow were studied qualitatively and quantitatively on a wing profile of a NACA 0012 airfoil. The wing, placed at a fixed incidence, is moved by harmonic oscillations parallel to the uniform nonperturbated flow. Flow characteristics were analyzed by comparing the vector development of total aerodynamic forces, static pressure distributions, and shear stress at the side of the profile, as well as the instantaneous flow visualizations at different phases in time.
Transl. by B.B.

N78-22062# Hellenic Air Force Technology Research Center, Athens (Greece). Aerodynamics Section.
DESIGN CRITERIA FOR THE NON-OCCURRENCE OF HIGH SPEED UNSTEADY SEPARATION ABOUT CONCAVE BODIES
A. G. Panaras *In* AGARD Unsteady Aerodyn. Feb. 1978 13 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

Two modes of instability were observed in the unsteady separated flow about some families of axisymmetric concave bodies. In the pulsation mode the conical separation bubble periodically inflates and expands radially. In the oscillation mode the conical foreshock and the accompanying shear layer oscillate laterally and their shape changes periodically from concave to convex. By means of theoretical arguments and an interpretation of the experimental data it was shown that the pulsation mode is caused by the formation of an annular supersonic jet at the intersection point of two shock envelopes evident during a brief part of the cycle. Additionally, it was found that the oscillation mode is most probably due to the non-satisfaction of the reattachment mechanism in a manner securing equilibrium of the pressure.
Author

N78-22063# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A RESUME OF AGARD SMP MEETING ON TRANSONIC UNSTEADY AERODYNAMICS
W. J. Mykytow and J. J. Olsen *In* AGARD Unsteady Aerodyn. Feb. 1978 20 p refs Summaries of papers presented at AGARD meeting, Unsteady Airloads in separated and Transonic Flow, Lisbon, Apr. 1977 (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

Progress in transonic unsteady aerodynamics and the state-of-the-art are summarized. The need to estimate reliable transonic unsteady airloads required for load, deflection, stress, stability, flutter, and gust analyses in this critical speed region is emphasized.
Author

N78-22064# Westland Helicopters Ltd., Yeovil (England).
THE IMPORTANCE OF UNSTEADY AERODYNAMICS IN ROTOR CALCULATIONS
G. H. Byham and T. S. Beddoes *In* AGARD Unsteady Aerodyn. Feb. 1978 23 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

The aerodynamic model required for rotor calculation methods is described. The impact of compressibility and dynamic stall on the limiting behavior of the rotor is discussed and it is shown, particularly for the condition of stall flutter, that the interaction of blades with discrete tip vortices is a major factor in controlling the blade torsional motion. It is indicated that wake distortion, particularly in the vertical plane, is necessary for detailed calculation of stall flutter.
Author

N78-22065# Naval Postgraduate School, Monterey, Calif.
UNSTEADY FLOWS IN TURBOMACHINES: A REVIEW OF CURRENT DEVELOPMENTS
M. F. Platzer *In* AGARD Unsteady Aerodyn. Feb. 1978 28 p refs (For availability see N78-22033 13-02)
(WR02403001)
Avail: NTIS HC A99/MF A01

The state-of-the-art of turbomachinery unsteady aerodynamics is reviewed with emphasis on theoretical prediction techniques.
Author

N78-22066# Detroit Diesel Allison, Indianapolis, Ind.
AERODYNAMIC PHENOMENA IN AN OSCILLATING TRANSONIC MCA AIRFOIL CASCADE INCLUDING LOADING EFFECTS
Sanford Fleeter and Ronald E. Riffel *In* AGARD Unsteady Aerodyn. Feb. 1978 16 p refs (For availability see N78-22033 13-02)
(Contract N00014-72-C-0351)
Avail: NTIS HC A99/MF A01

The steady, quasi-steady, and unsteady aerodynamics were determined for a multiple circular arc (MCA) airfoil cascade which modeled the tip section of an advanced design fan blade. The steady airfoil surface aerodynamic performance of the cascade was measured at two levels of aerodynamic loading and correlated with the predictions from a time-marching, steady, transonic flow analysis. The chordwise distribution of the quasi-static unsteady pressure coefficient for a 0 deg interblade phase angle was determined and correlated with two appropriate predictions: one based on the steady transonic analysis and the other on steady inviscid supersonic flat plate theory. Finally, the MCA cascade was harmonically oscillated in the torsional mode at a reduced frequency value of 0.14. The fundamental unsteady aerodynamic data was obtained at a Mach number equal to 1.55 over a range of interblade phase angles for two values of the cascade static pressure ratio. Results were correlated with the predictions from state-of-the-art unsteady flat plate cascade analyses.
Author

N78-22067# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
DETERMINATION OF THE VORTEX SHEDDING FREQUENCY OF CASCADE WITH DIFFERENT TRAILING EDGE THICKNESS
Hans-J. Heinemann and Karl A. Buetefisch *In* AGARD Unsteady Aerodyn. Feb. 1978 11 p refs (For availability see N78-22033 13-02)
Avail: NTIS HC A99/MF A01

An electro-optical method developed to determine the shedding frequency of the vortices in the wakes flow is used in testing the flow through various hub-, mid-, and tip-section turbine cascade for various downstream Mach numbers in the sub-and transonic flow regimes. The trailing edge thickness of the blades vary from 0.8 to 5 percent of the blade chord length. These trailing edges lead to higher frequencies than thicker ones at constant Mach numbers.
Author

N78-23034# European Space Agency, Paris (France).
A THEORY ON THE CORE OF HIGHLY ROLLED-UP VORTEX SHEETS
Jean-Pierre Guiraud and Radyacour K. Zeytounian *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 1-16 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 205-212 Original report in FRENCH previously announced as A76-46364 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N78-22068# Defense Systems Management School, Fort Belvoir, Va.
THE MSG-2 COMMERCIAL AIRLINE CONCEPT: A DEPARTMENT OF DEFENSE PROGRAM FOR RELIABILITY-CENTERED MAINTENANCE
Francis William Ahearn Nov. 1977 72 p refs
(AD-A050531) Avail: NTIS HC A04/MF A01 CSCL 05/1

MSG-2 is a planning and analysis technique developed by the commercial airlines to streamline scheduled maintenance requirements by capitalizing upon the inherent reliability of systems and equipment through greater use of condition monitoring. The study examines MSG-2 development in the commercial sector along with the substantial successes realized in reducing support costs that prompted the Department of Defense to incorporate MSG-2 into its own Reliability-Centered Maintenance (RCM) program. Army, Navy, and Air Force approaches for implementing RCM are analyzed in detail. The current status and future plans for aircraft/equipment programs subjected to the analysis are also examined. Features of the three Services' approaches are contrasted and a number of conclusions are drawn concerning RCM training, contract versus organic efforts, and new procurement versus existing inventory aircraft systems. Finally, several recommendations for further research and policy changes are suggested. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N78-22069# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
PREDICTION MODEL OF ATCRBS TRANSIENT EFFECTS PERFORMANCE Final Report, 1974 - 1975
Norman Theberge (IIT Res. Inst., Annapolis, Md.) Jun. 1976 53 p
(Contracts DOT-FA70WAI-175; F19628-76-C-0017; FAA Proj. 213-661-10; AF Proj. 649E)
(AD-A049811/3; ECAC-PR-76-017; FAA-RD-77-75) Avail: NTIS HC A04/MF A01 CSCL 17/7

A pulse by pulse simulation of the air traffic control radar beacon system (ATCRBS), was adapted for use with the UNIVAC 1110 computer. The model was made more flexible by adding the capability to use automated input information about ATCRBS and aircraft deployment. A terrain mode was added so the effects of terrain on coverage can be assessed. In addition, routines were added that simulate the effects of staggered and jittered PRF's and transponder reply codes, so that near synchronous interference problems, broken and false targets, and other time-related anomalies can be investigated. Code data sampling and code validation functions of the following digital processors were also included in the simulation: ARTS III, AN/TPX-42, and the AN/FYQ-49 common digitizer. Author

N78-22070*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
TRAN*STAR 2 EVALUATION FOR NOAA DATA BUOY OFFICE, PART A Final Report
Aug. 1976 8 p
(NASA-TM-79443; ESSL-76-18-Pt-A) Avail: NTIS HC A02/MF A01 CSCL 17G

The capability of the TRAN*STAR 2 receiver equipment utilizing the U.S. Navy Navigation Satellite System to provide reliable position locations with reasonable accuracy and frequency was evaluated. Two receivers, an antenna, and a test set were procured, and position fix data collected at NSTL from a fixed known location during the months of May and June. The data were processed through a computer program and analyzed. The results of the evaluation are summarized. Author

N78-22071*# Systems Technology, Inc., Hawthorne, Calif.
DEVELOPMENT OF AUTOMATIC AND MANUAL FLIGHT DIRECTOR LANDING SYSTEMS FOR THE XV-15 TILT ROTOR AIRCRAFT IN HELICOPTER MODE
L. G. Hofmann, Roger Hoh, H., Wayne F. Jewell, Gary L. Teper, and Pradip D. Patel Jan. 1978 254 p refs
(Contract NAS2-9392)
(NASA-CR-152040; TR-1092-1) Avail: NTIS HC A12/MF A01 CSCL 01E

The objective of this effort is to determine IFR approach path and touchdown dispersions for manual and automatic XV-15 tilt rotor landings, and to develop missed approach criteria. Only helicopter mode XV-15 operation is considered. The analysis and design sections develop the automatic and flight director guidance equations for decelerating curved and straight-in approaches into a typical VTOL landing site equipped with an MLS navigation aid. These system designs satisfy all known pilot-centered, guidance and control requirements for this flying task. Performance data, obtained from nonstationary covariance propagation dispersion analysis for the system, are used to develop the approach monitoring criteria. The autoland and flight director guidance equations are programmed for the VSTOLAND 1819B digital computer. The system design dispersion data developed through analysis and the 1819B digital computer program are verified and refined using the fixed-base, man-in-the-loop XV-15 VSTOLAND simulation. Author

N78-22428 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DOPPLER POINT POSITIONING USING THE N.N.S.S. BROADCAST EPHEMERIS
Peter Wilson *In its* Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 131-136 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-23016*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTIMUM HORIZONTAL GUIDANCE TECHNIQUES FOR AIRCRAFT
Heinz Erzberger and Homer Q. Lee *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 175-184 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 17G

N78-23017*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
INERTIALLY-AIDED, ALL-WEATHER LANDING SYSTEMS FOR C/TOL
Robert J. Pawlak *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 185-197 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 17G

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-22072 Oklahoma State Univ., Stillwater.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF THE DYNAMIC RESPONSE OF A SEMI-MONOCOQUE AIRCRAFT WING STRUCTURE Ph.D. Thesis
Thomas Denny Jordan 1976 161 p
Avail: Univ. Microfilms Order No. 78-01274

The study was conducted in two phases: analytical and experimental. A finite element model for the dynamic response of an F-84 aircraft wing was developed that could be easily modified to incorporate structural changes. This model was subsequently modified to predict the dynamic response of a damaged F-84 aircraft wing. Guyan reduction was applied to the finite element model to minimize computer time, storage, and cost. In conjunction with the analytical work, an experimental

program was conducted to determine the natural frequencies and mode shapes of the undamaged and damaged configurations. The results from both phases are compared to determine the suitability of the analytical model. Highly complex semi-monocoque structures could be modeled adequately with rod and shear panel finite elements and lumped mass.Dissert. Abstr.

N78-22073*# National Aeronautics and Space Administration, Washington, D. C.

ALTERNATE-FUELED TRANSPORT AIRCRAFT POSSIBILITIES

W. S. Aiken France Assoc. Aeronautique et Astronautique de France 1977 37 p refs Presented at The 13th Congr. Intern. Aeron., Paris, 2-3 Jun. 1977

(NASA-TM-78330; Note-77-30; ISBN-2-7170-0455-6) Avail: NTIS HC A03/MF A01 CSCL 01C

The paper is organized to describe: (1) NASA's cryogenically fueled aircraft program; (2) LH2 subsonic and supersonic transport design possibilities (3) the fuel system and ground side problems associated with LH2 distribution; (4) a comparison of LCH4 with LH2; (5) the design possibilities for LCH4 fueled aircraft; and (6) a summary of where NASA's cryogenically fueled programs are headed. Author

N78-22074*# Boeing Commercial Airplane Co., Seattle, Wash. Preliminary Design Dept.

APPLICATION OF ADVANCED TECHNOLOGIES TO SMALL, SHORT-HAUL AIRCRAFT Final Report

D. G. Andrews, P. W. Brubaker, S. L. Bryant, C. W. Clay, B. Giridharadas, M. Hamamoto, T. J. Kelly, D. K. Proctor, C. E. Myron, and R. L. Sullivan 1 Mar. 1978 332 p refs

(Contract NAS2-9506)

(NASA-CR-152089; D6-46320) Avail: NTIS HC A15/MF A01 CSCL 01C

The results of a preliminary design study which investigates the use of selected advanced technologies to achieve low cost design for small (50-passenger), short haul (50 to 1000 mile) transports are reported. The largest single item in the cost of manufacturing an airplane of this type is labor. A careful examination of advanced technology to airframe structure was performed since one of the most labor-intensive parts of the airplane is structures. Also, preliminary investigation of advanced aerodynamics flight controls, ride control and gust load alleviation systems, aircraft systems and turbo-prop propulsion systems was performed. The most beneficial advanced technology examined was bonded aluminum primary structure. The use of this structure in large wing panels and body sections resulted in a greatly reduced number of parts and fasteners and therefore, labor hours. The resultant cost of assembled airplane structure was reduced by 40% and the total airplane manufacturing cost by 16% - a major cost reduction. With further development, test verification and optimization appreciable weight saving is also achievable. Other advanced technology items which showed significant gains are as follows: (1) advanced turboprop-reduced block fuel by 15.30% depending on range; (2) configuration revisions (vee-tail)-empennage cost reduction of 25%; (3) leading-edge flap addition-weight reduction of 2500 pounds. Author

N78-22075*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE PROMISE OF ADVANCED TECHNOLOGY FOR FUTURE AIR TRANSPORTS

Robert E. Bower Apr. 1978 41 p refs Presented at the SAE Intern. Air Transportation Conf., Boston, 1-4 May 1978

(NASA-TM-78712) Avail: NTIS HC A03/MF A01 CSCL 01C

Progress in all weather 4-D navigation and wake vortex attenuation research is discussed and the concept of time based metering of aircraft is recommended for increased emphasis. The far term advances in aircraft efficiency were shown to be skin friction reduction and advanced configuration types. The promise of very large aircraft, possibly all wing aircraft is discussed, as is an advanced concept for an aerial relay transportation system. Very significant technological developments were identified that can improve supersonic transport performance and reduce noise. The hypersonic transport was proposed as the ultimate step in air transportation in the atmosphere. Progress in the key technology areas of propulsion and structures was reviewed. Finally, the impact of alternate fuels on future air transports was considered and shown not to be a growth constraint. Author

N78-22076*# Sperry Flight Systems, Phoenix, Ariz.

DESCRIPTION AND THEORY OF OPERATION OF THE COMPUTER BY-PASS SYSTEM FOR THE NASA F-8 DIGITAL FLY-BY-WIRE CONTROL SYSTEM Final Report

May 1978 99 p

(Contract NAS4-2248)

(NASA-CR-144865) Avail: NTIS HC A05/MF A01 CSCL 01C

A triplex digital flight control system was installed in a NASA F-8C airplane to provide fail operate, full authority control. The triplex digital computers and interface circuitry process the pilot commands and aircraft motion feedback parameters according to the selected control laws, and they output the surface commands as an analog signal to the servoelectronics for position control of the aircraft's power actuators. The system and theory of operation of the computer by pass and servoelectronics are described and an automated ground test for each axis is included. Author

N78-22077# Royal Aircraft Establishment, Farnborough (England).

THE COLLECTION AND ANALYSIS OF FATIGUE DAMAGE OCCURRING IN AIRCRAFT IN SERVICE

H. Huth and D. Shutz Aug. 1977 31 p refs Transl. into ENGLISH of "Sammlung und Analyse von im Betrieb von Luftfahrzeugen aufgetretenen ermudungsschaden", Lab. fuer Betriebsfestigkeit, Darmstadt, 25 Nov. 1976

(RAE-Lib-Trans-1934; BR61905) Avail: NTIS HC A03/MF A01

In order to create guidelines for the planning of future research projects aimed at improving the fatigue strength of aircraft structures, data on fatigue damage occurring in service and in full scale tests have been collected and analysed. A total of 529 cracks in 27 different samples have been covered. These fatigue cracks have been classified, analysed, and evaluated statistically to enable evidence on the main weaknesses and causes of damage to be derived therefrom. Author

N78-22078# Sacramento Air Logistics Center, McClellan AFB, Calif. Aircraft Systems Engineering.

F-111 DEPOT FUSELAGE FUEL TANK DESEAL/RESEAL PROCEDURES Final Report

P. Steinweg 29 Apr. 1977 226 p Supersedes AEI-200-1060

(AD-A050819; Rept-12AEI-200-1060B) Avail: NTIS HC A11/MF A01 CSCL 01/3

The original EC5106 sealant in F-111 aircraft fuel tanks was deteriorating, resulting in unacceptable leaks. To correct this problem, the tanks were to be desealed and resealed with MIL-S-83430 polysulfide sealant. However, laboratory tests indicated that the MIL-S-83430 sealant alone would be attacked by the reverted EC5106 sealant to the extent that the deseal/reseal process would be required again in about five years. It is impossible to remove all the reverted sealant. The Physical Sciences Laboratory Section of the Sacramento ALC Industrial Products Division determined by testing that EC2216 epoxy, added as a barrier, would prevent damage to the MIL-S-83430 sealant for at least ten years. The report establishes procedures to accomplish the complete desealing and resealing of F-111D aircraft, assuring a positive seal throughout all of the fuselage integral fuel tanks. Author (GRA)

N78-22079# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Flight Vehicle Branch.

FLIGHT PERFORMANCE OF THE BQM-34A TARGET DRONE WITH WING-TIP MOUNTED PODS Final Report, Dec. 1974 - Jun. 1976

J. P. Boone, R. W. Blohm, and Russell F. Osborn, Jr. Sep. 1977 237 p refs

(AD-A050834; AFFDL-TR-77-82) Avail: NTIS HC A11/MF A01 CSCL 01/3

Flight performance of the BQM-34A aerial target configured with wing tip mounted pods is documented in this report. Aerodynamic analysis along with flight test validation is presented

and is used to update charts in the Flight Controller Manual, the Technical Order 21M-BQM-34A-1. Data from 23 flights, representing the clean configuration plus three pod configurations, is presented. The analysis methods, estimating drag increments caused by the pods, are described as well as the data acquisition and processing methods. GRA

N78-22080# Army Inst. for Advanced Russian and East European Studies, APO New York. 09053
THE SOVIET ATTACK HELICOPTER
Kevin V. Culhane Mar. 1977 15 p
(AD-A050649) Avail: NTIS HC A02/MF A01 CSCL 01/3

This paper examines the evolution of the Soviet attack helicopter through its initial 'gunship' stages to the present sophisticated 'HIND D'. Also, it addresses the corresponding changes in Soviet helicopter tactics which have accompanied their increase in both firepower and maneuverability under the influence on Indochina and the Middle East experiences. Finally, a brief look is taken at possible future development of the attack helicopter force of the Soviet Union. Specifically, the author predicts that the Soviets will forsake the present scout, attack, and transport abilities of the Hind for a more powerfully equipped and more armored 'artillery platform' type helicopter.
Author (GRA)

N78-22081# Boeing Vertol Co., Philadelphia, Pa.
HLH ROTOR BLADE MANUFACTURING TECHNOLOGY DEVELOPMENT REPORT Final Report
Sep. 1977 253 p
(Contract DAAJ01-71-C-0840)
(AD-A050592; D301-10280-1; USAAMRDL-TR-77-39) Avail: NTIS HC A12/MF A01 CSCL 01/3

This document describes the manufacturing technology development effort for the HLH/ATC rotor blade. Trade-off studies leading to the selection of the manufacturing and tooling concepts, and the details of blade fabrication are described herein; in addition, the nondestructive test and other quality assurance techniques used to ensure development of a flight-worthy rotor blade are described. Finally, the tooling and fabrication changes being implemented as a result of full-scale blade testing in the last six months of the ATC program are presented. The conclusions reached as a result of the 3-year HLH/ATC rotor blade manufacturing development effort have: (1) verified the tooling and manufacturing approach utilized; and (2) provided convincing evidence that the rotor blade design is cost-effective, producible, and has the potential for high-rate, low-cost production through automated tooling and manufacturing methods. GRA

N78-22082# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEMS DYNAMIC ANALYSIS Final Report, 7 Mar. 1974 - 18 Feb. 1977
G. E. Amies, N. J. Pierce, J. B. Greene, and R. J. Levek Oct. 1977 464 p refs
(Contract F33615-74-C-2016)
(AD-A050907; AFAPL-TR-77-63) Avail: NTIS HC A20/MF A01 CSCL 13/7

This report describes the development and verification of four computer programs used to simulate hydraulic systems under dynamic conditions. The programs were developed by McDonnell Douglas Corp. under contract with the Air Force. The Hydraulic Systems Frequency Response (HSFR) program predicts the ripple in the flow from piston-type pumps and shows how it is transmitted and attenuated through the system. It predicts the resonant frequencies and the locations and amplitudes of the standing waves of the oscillatory flow and pressure. The Steady-State Flow Analysis (SSFAN) program defines the system flow and pressure distribution resulting from the simultaneous operation of actuator devices under any combinations of loads and rates. The Hydraulic Transient Analysis (HYTRAN) program simulates the dynamic response of a system to sudden changes in load flow demand. The typical input to the system is a valve motion from which pressure and flow disturbances propagate through the system, causing pump and component responses. The Hydraulic Transient Thermal Analysis (HYTTHA) program predicts the effects of system heat generation and dissipation of the temperatures and performance of a hydraulic system. GRA

N78-22083# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
BASIC AERODYNAMIC RESEARCH ON THE AIRFRAME INTEGRATION OF HIGH BYPASS ENGINES, PART 1 Final Report
Wolfgang Brix, Franz Fischer, Karl-Dieter Klevenhusen, Claus Sommer, and Ottmar Wehrmann Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1977 192 p refs In GERMAN; ENGLISH summary
(Contract BMFT-LFF-33)
(BMFT-FB-W-77-20) Avail: NTIS HC A09/MF A01; ZLDI, Munich DM 40,30

Some results of the VTOL basic research were utilized for investigating the airframe integration of high bypass engines. The well known panel method was used for the theoretical work, including engine jet effects. It was necessary, after the successful VFW 614 flight testing, to expand and consolidate the experience gained in the development of the VFW 614 in the field of airframe engine integration. Research included experimental (force and pressure measurements) and theoretical work. The effects of engine positioning on the aircraft aerodynamic coefficient are emphasized. The jet effects are of great importance for the aerodynamic efficiency of this type of configuration. The importance is confirmed of interference optimal engine positioning with its strong influence on the efficiency and quality of future civil aircraft development. Author (ESA)

N78-22084# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
SUPPORTING PROJECT ACTIVITIES IN THE CIVIL COMPONENTS PROGRAM 'WING SECTION' Final Report
Manfred Wittmann and Joachim Hempel Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1977 58 p refs In GERMAN; ENGLISH summary Prepared jointly with MBB, Hamburg
(Contract BMFT-LFK-7511/12)
(BMFT-FB-W-77-26) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 12,20

The supporting project work for the 'Wing Section' program should guarantee the application of the aerodynamic test results for an Airbus type aircraft. This was accomplished by determining the market situation up to the 1990's and by taking into consideration the European Airlines Outline Requirements. Possible engine-wing combinations, including rear fuselage installations, are discussed. The final chosen design is similar to the Airbus variant B 10 with a wing area of about 210 sq m. The range of 1500 nm corresponds to the requirements of the European Airlines for short/medium haul aircraft. Differences with the Airbus program are a reduced sweep angle, larger wing thickness, and a wing loading comparable to the B 10 X of HSA. These changed parameters are strongly related to a supercritical wing profile and serve as inputs to the aerodynamic design of the wing.
Author (ESA)

N78-22085# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
CIVIL COMPONENTS PROGRAM 'WING SECTION'. PRELIMINARY DESIGN OF MODEL WING AND PYLON MOCK-UPS Final Report
Eckhard Meisel Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1977 52 p In GERMAN; ENGLISH summary
(Contract BMFT-LFK-7511)
(BMFT-FB-W-77-27) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 10,95

A preliminary design of the large wind tunnel model which will be tested in the Modane S 1 tunnel was conceived. Applicability of several structural designs with reference to stress, stiffness, integration of equipment, cost, and workshop possibilities was studied. A structural design with a welded hollow steel box and solid aluminum alloys deck planks was chosen for the final design. Author (ESA)

N78-22086# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
CIVIL COMPONENTS PROGRAM 'WING SECTION'. PRELIMINARY DESIGN OF ENGINE MOUNTING Final Report
Hartmut Drexhage Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1977 35 p In GERMAN; ENGLISH summary

(Contract BMFT-LFK-7511)
(BMFT-FB-W-77-28) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 7,35

Preliminary design studies are reported on engine mounting and the mounting of the throughflow nacelle for wind tunnel testing. The following problems are mentioned: possibilities for separate engine mounting and synchronous incidence adjustment, adjustment possibilities, adjustment drive, and adjustment control. ESA

N78-22087# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
ENGINE PROCUREMENT FOR THE TEST PROGRAM 'CIVIL COMPONENTS PROGRAM WING SECTION' Final Report
Bernd Viebcke Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1977 86 p In GERMAN; ENGLISH summary
(Contract BMFT-LFK-7511)
(BMFT-FB-W-77-29) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 18,05

A real engine was chosen and modified for optimum simulation of the basic engines, CFM 56/F1 B1 and CF 6-45 for experimental configuration studies of lift, drag, and momentum. A theoretical comparison of model engine characteristics with full scale engine characteristics is given and problems of transferring the results are discussed. For the Astafan 2 A-engine of Turbomeca the working envelope of the wind tunnel S1MA in Modane is given and the preliminary tests are planned. A rental contract between Turbomeca and VFW-Fokker with corresponding cost estimates was drafted. It was found that the Astafan 2 A-engine is suitable for the test program and Turbomeca is willing to make the engine available for testing at ONERA (Modane). Author (ESA)

N78-22088# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
CIVIL COMPONENTS PROGRAM 'WING SECTION'. WING STRUCTURE PARAMETER STUDY Final Report
Rainer vomBaur and Herbert Sadowski Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1977 67 p refs In GERMAN; ENGLISH summary
(Contract BMFT-LFK-7511)
(BMFT-FB-W-77-30) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 14,10

The results of this parameter studied should facilitate the recording of the influence on the wing weight due to the change of essential wing parameters, especially in the early stage of the project phase. It is known to be problematical to state correctly the weight changes of varying importance arising from parameter variation without carrying out thorough analytical examinations. While elaborating this study several steps had to be passed in order to describe concisely in a diagram the influence of parameters varying the wing weight. Results are discussed and some aspects of the production procedure and cost, particularly the development and procurement cost, and the direct operation cost are dealt with. Author (ESA)

N78-22089# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
CIVIL COMPONENTS PROGRAM 'WING SECTION'. CONCEPT FOR LARGE MODEL TESTS AT MODANE Final Report
Gerhard Anders, Eberhard Graewe, and Volker Renken Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1977 76 p refs
(Contract BMFT-LFK-7511)
(BMFT-FB-W-77-31) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 16

The concept is introduced for the large scale model tests to be carried out in the large transonic windtunnel S 1 at Modane, France. The model arrangement and the testing concept is described. The following subjects are discussed: measuring system, data processing, and presentation. A preliminary test program is presented for time and cost planning. A time schedule gives a general survey of the whole project. Author (ESA)

N78-22090# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
CIVIL COMPONENTS PROGRAM 'WING SECTION'. POSITION OF STRUCTURE TRANSITION JOINTS, ARRANGEMENT OF LANDING GEAR Final Report
Karl Lettow and Hans Fischer Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1977 26 p In GERMAN; ENGLISH summary
(Contract BMFT-LFK-7512)
(BMFT-FB-W-77-36) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 5,45

Proposals are made for the wing structure transition joints. The space required for a retracted landing gear assuming a given profile and a given aircraft basic design was investigated. ESA

N78-22091# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
CIVIL COMPONENTS PROGRAM 'WING SECTION'. MATERIALS SELECTION Final Report
Hans-Juergen Tilch Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1977 53 p refs In GERMAN; ENGLISH summary
(Contract BMFT-LFK-7512)
(BMFT-FB-W-77-37) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 10,70

The materials used for the wing main components of a number of modern transport aircraft are listed and a review is presented of new light metal alloys of high strength. The possible use of composites is dealt with in particular. This, in the case of a transporter of the 80's, is restricted to certain structural component parts (fail-safe parts for security of testing). Material recommendations resulting herefrom, in regard to the main components of a new wing, refer mainly to aluminum alloys. These materials, in view of their strength and price, will be the basic structural material in future civil aircraft. Author (ESA)

N78-22092# Rolls-Royce Ltd., Derby (England)
SOME PRACTICAL LIMITATIONS TO FUEL-CONSERVATIVE CIVIL ENGINE TECHNOLOGY
P. H. Young Paris Assoc. Aeron. et Astronautique de France 1977 21 p refs Presented at the 13th Intern. Aeron. Congr., Paris, 3 Jun. 1977
(AAAF-NT-77-29; ISBN-2-7170-0454-8) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

The propulsion of future medium and long range subsonic civil aircraft launched before 1990 is discussed. The engines will operate well into the 21st century when natural petroleum sources will dry up. It is forecast that industry will find some means of providing the necessary fuel, which will be similar to current aviation fuels and, even if it has to be manufactured from coal or shale, its price need not exceed 70 cents/USF at 1976 equivalent prices. Hence, lowest possible direct operating costs will continue to be the goal of engine optimization. The predicted long term fuel price is shown to not significantly change the relative importance of weight and specific fuel consumption. Also, the future medium and long range engines will have the same overall pressure ratio and specific thrust. The long term shortage of natural fuel does not improve the position of the heat exchanger cycle. Research should continue to concentrate on weight reduction and component efficiency improvement. The absolute importance in terms of money of first costs and part costs will not change. The long term future of supersonic travel depends, apart from the problem of noise, on the achievement of direct operating costs similar to those of the subsonic competition. ESA

N78-22093# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE MULTI-PANEL SYMPOSIUM ON FIGHTER AIRCRAFT DESIGN
H. Andrews (Dept. of the Navy, Washington, D.C.) and R. J. Balmer (British Aerospace Aircraft Group, Kingston-Upon-Thames (England)) Feb. 1978 14 p Symp. held at Florence, 3-6 Oct. 1977
(AGARD-AR-119; ISBN-92-835-1275-8) Avail: NTIS HC A02/MF A01

The proceedings of a symposium on fighter aircraft design were evaluated. The primary conclusions of the report are that technology is available, in all areas of fighter design, to meet the military requirements for the 80's. However, the cost of using the most advanced technology to meet every conceivable requirement can be exorbitant. Cost-effectiveness is of vital importance. Operational requirements must be carefully developed

and clearly defined so as to ensure the most economical solution. Fighter aircraft must be designed with sufficient flexibility to meet the changing needs during their service life. Research and development should be directed towards those areas offering the most cost-effective solutions. Author

N78-23028*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
A NEW FORMULATION FOR THE EPSILON METHOD APPLIED TO THE MINIMUM-TIME-TO-CLIMB PROBLEM
Lawrence W. Taylor, Jr. and Harriet J. Smith *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 423-434 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

N78-22094 Illinois Univ., Urbana-Champaign.
DESIGN OF PROPELLERS FOR MINIMUM NOISE Ph.D. Thesis
Chung-Jin Woan 1977 205 p
Avail: Univ. Microfilms Order No. 78-04196

The investigation was concerned with the theoretical design of propellers to obtain minimum noise, subject to constrains on the aerodynamic performance and wake configuration. In this analysis, which was based on both acoustic and aerodynamic considerations, attention was given only to the rotational noise due to static sources. Based on lifting surface theory, the functional relation between the mean line at any radius, the distribution of loading (circulation), and propeller blade thickness was developed. Also developed was the functional relation between the ensemble mean square of acoustic pressure and the distribution of circulation and propeller blade thickness. From these relations, a general problem of propeller design for minimum noise was stated. In order to achieve a tractable numerical formulation of this general problem, the lifting surface model was further approximated by a lifting-line model. Dissert. Abstr.

N78-22095 Maryland Univ., College Park.
TURBOJET ENGINE PERFORMANCE AT HIGH TURBINE ENTRY TEMPERATURES WITH TRANSPIRATION COOLED TURBINE BLADING Ph.D. Thesis
Stuart William Greenwood 1977 186 p
Avail: Univ. Microfilms Order No. 78-04493

An analytical and computational investigation was conducted on the design-point performance of turbojets operating at high turbine entry temperatures at combustor equivalence ratios as high as unity. The turbines were transpiration cooled, where necessary, by air fed from the compressor delivery, and performance was examined for engines fitted with both single stage and two stage turbines. The flight conditions considered were takeoff, subsonic cruise, and supersonic cruise at Mach 2.1 and Mach 2.7. The turbine design selected was a NASA turbine with geometric characteristics considered desirable for high temperature engines, and incorporated thick blade sections, low blade solidity, and blunt leading and trailing edges. An analytical investigation was conducted to relate the secondary flow losses for this turbine to the two dimensional losses at the mean blade section. Dissert. Abstr.

N78-22096*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
F100(3) PARALLEL COMPRESSOR COMPUTER CODE AND USER'S MANUAL Contractor Report, Mar. 1977 - Feb. 1978
R. S. Mazzawy, D. A. Fulkerson, D. E. Haddad, and T. A. Clark May 1978 52 p refs
(Contract NAS3-20610)
(NASA-CR-135388; PWA-5549-8) Avail: NTIS HC A04/MF A01 CSCL 21E

The Pratt & Whitney Aircraft multiple segment parallel compressor model has been modified to include the influence of variable compressor vane geometry on the sensitivity to circumferential flow distortion. Further, performance characteristics of the F100 (3) compression system have been incorporated into the model on a blade row basis. In this modified form, the distortion's circumferential location is referenced relative to the variable vane controlling sensors of the F100 (3) engine so that the proper solution can be obtained regardless of distortion orientation. This feature is particularly important for the analysis of inlet temperature distortion. Compatibility with fixed geometry compressor applications has been maintained in the model. Author

N78-22097*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPACT BEHAVIOR OF FILAMENT WOUND GRAPHITE/EPOXY FAN BLADES
Kenneth J. Bowles 1978 19 p refs Presented at the 23d Natl. SAMPE Symp. and Exhibition, Anaheim, Calif., 2-4 May 1978
(NASA-TM-78845; E-9562) Avail: NTIS HC A02/MF A01 CSCL 21E

The fabrication and impact tests of graphite/epoxy filament wound fan blades are discussed. Blades which were spin tested at tip speeds up to 305 meters per second retained their structural integrity. Two blades were each impacted with a 454 gram slice of a 908 gram simulated bird at a tip speed of 263 meters per second and impact angles of 22 and 32 deg. The impact tests were recorded with high-speed movie film. The blade which was impacted at 22 deg sustained some root delamination but remained intact. The 32 deg impact separated the blade from the root. No local damage other than leading edge debonding was observed for either blade. Results of a failure mode analysis are also discussed. Author

N78-22098*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REDUCTION OF AIRCRAFT GAS TURBINE ENGINE POLLUTANT EMISSIONS Status Report
Larry A. Diehl 1978 17 p refs Proposed for presentation at 71st Ann. Meeting of the Air Pollution Control Assoc., Houston, Tex., 26-30 Jun. 1978
(NASA-TM-78870; E-9601) Avail: NTIS HC A02/MF A01 CSCL 21E

To accomplish simultaneous reduction of unburned hydrocarbons, carbon monoxide, and oxides of nitrogen, required major modifications to the combustor. The modification most commonly used was a staged combustion technique. While these designs are more complicated than production combustors, no insurmountable operational difficulties were encountered in either high pressure rig or engine tests which could not be resolved with additional normal development. The emission reduction results indicate that reductions in unburned hydrocarbons were sufficient to satisfy both near and far-termed EPA requirements. Although substantial reductions were observed, the success in achieving the CO and NOx standards was mixed and depended heavily on the engine/engine cycle on which it was employed. Technology for near term CO reduction was satisfactory or marginally satisfactory. Considerable doubt exists if this technology will satisfy all far-term requirements. Author

N78-22099*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LEAN COMBUSTION LIMITS OF A CONFINED PREMIXED-PREVAPORIZED PROPANE JET

Kenneth L. Huck and Cecil J. Marek Apr. 1978 23 p refs (NASA-TM-78868; E-9453) Avail: NTIS HC A02/MF A01 CSCL 21B

Lean blowout limits were reported for a premixed prevaporized propane jet issuing into a cylindrical combustor. A single hole in a flat plate was used as a flameholder. Flameholders with various hole diameters were used. Jet velocities were varied from 3 to 290 meters per second. The combustor cross sectional area was changed by using different quartz liners of 12.7 and 22.2 millimeters diameters. As a result the combustor Reynolds number varied from 1000 to 9000. Stability was achieved at laminar as well as turbulent conditions. Three zones of flame stability were observed. The blowout equivalence ratio varied with step size and the combustor and jet Reynolds numbers. The combustor inlet mixture temperature was 395 K, and the combustor pressure was 1 atmosphere. Author

N78-22100*# Rockwell International Corp., Columbus, Ohio. Aircraft Div.

STATIC TESTS OF A LARGE SCALE SWIVEL NOZZLE THRUST DEFLECTOR

John F. Federspiel Feb. 1978 44 p refs (Contract NAS2-9176) (NASA-CR-152091; NR78H-10) Avail: NTIS HC A03/MF A01 CSCL 21E

Tests were conducted on a swivel nozzle thrust deflector installed on a 91 centimeter (36 inch) low pressure ratio tip turbine fan. Fan power was supplied by a J-85 hot gas generator. The configuration was typical of a vertical/short takeoff and landing (V/STOL) aircraft propulsion system employing lift cruise fans. The performance was compared to results obtained on an 0.15 scale cold flow model. Data were obtained at fan pressure ratios from 1.1 to 1.2 and at nozzle deflections from cruise (0 deg) to VTOL (90 deg). The nozzle thrust performance was in good agreement with small scale VTOL thrust coefficients. Configurations with increased nozzle area showed lower performance. Fan operation was routine and nozzle rotation caused no circumferential distortions of the fan exit flow. Nozzle flow characteristics did not repeat small scale model results. Measured flow coefficients were smaller on the large scale test. It was concluded that lack of simulation of pressure and temperature profiles of the tip driven fan was the most probable cause of the discrepancy. Author

N78-22101*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IN-PLACE RECALIBRATION TECHNIQUE APPLIED TO A CAPACITANCE-TYPE SYSTEM FOR MEASURING ROTOR BLADE TIP CLEARANCE

John P. Barranger Apr. 1978 35 p refs (NASA-TP-1110; E-9395) Avail: NTIS HC A03/MF A01 CSCL 20E

The rotor blade tip clearance measurement system consists of a capacitance sensing probe with self contained tuning elements, a connecting coaxial cable, and remotely located electronics. Tests show that the accuracy of the system suffers from a strong dependence on probe tip temperature and humidity. A novel inplace recalibration technique was presented which partly overcomes this problem through a simple modification of the electronics that permits a scale factor correction. This technique, when applied to a commercial system significantly reduced errors under varying conditions of humidity and temperature. Equations were also found that characterize the important cable and probe design quantities. Author

N78-22102# Union Carbide Corp., Parma, Ohio. Technical Center.

RUB TOLERANT MATERIALS DEVELOPMENT. NICKEL-CHROMIUM-ALUMINUM FOR USE AS A TRANSPIRATION-COOLED HIGH PRESSURE TURBINE ABRADABLE SEAL Final Report, Jun. 1976 - Apr. 1977

R. J. Dufala Wright-Patterson AFB, Ohio AFAPL Oct. 1977 157 p (Contract F33615-76-C-2098) (AD-A051000; AFAPL-tr-77-46) Avail: NTIS HC A08/MF A01 CSCL 21/5

A transpiration-cooled, high pressure gas turbine shroud was designed, built, and rig tested. The shroud consisted of a porous rub tolerant material, nickel-chromium-aluminum (NiCrAl) which was brazed to a flow control/cooling gas distribution chamber. The NiCrAl layer was optimized for abradability and thermal stability. A flow control chamber was designed which controlled the amount and distribution of the cooling gas flow to the rub tolerant layer. The shroud was tested for cyclic oxidation resistance and high velocity, hot gas erosion stability. Optimization of the system for maintaining a 1900 F (1040 C) surface temperature in a high velocity, 2600 F (1427 C) gas stream was achieved by using a combination of thermal conduction and transpiration cooling mechanisms. Author (GRA)

N78-22103# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

THE EFFECTS OF CAM AND NOZZLE CONFIGURATIONS ON THE PERFORMANCE OF A CIRCULATION CONTROL ROTOR PNEUMATIC VALVING SYSTEM Final Report, Oct. 1973 - Jan. 1974

Kenneth R. Reader Nov. 1977 49 p refs (AD-A050494; DTNSRDC/ASED-393) Avail: NTIS HC A03/MF A01 CSCL 13/11

Basic research was conducted on the sensitivity of such component parts of a cam-type pneumatic valving system as cam eccentricity, nozzle aspect ratio, nozzle shape, nozzle endplates, slot exit area, and transition zone between the nozzle and blade entrance. Data are presented which show how systematic variations of these components affect the total pressure loss coefficient, the mass flow rate, and the jet velocity. Information on the sensitivity of these parameters enhances the capabilities to design a cam-type pneumatic valve. It was concluded that cam eccentricity had no effect on the characteristic curve for total pressure loss coefficient versus area coefficient. GRA

N78-22104# Borst (Henry V.) and Associates, Wayne, Pa.

AERODYNAMIC DESIGN AND ANALYSIS OF PROPELLERS FOR MINI-REMOTELY PILOTED AIR VEHICLES. VOLUME 1: OPEN PROPELLERS Final Report, Jun. 1976 - Aug. 1977

Henry V. Borst Jan. 1978 131 p refs (Contract DAAJ02-76-C-0031; DA Proj. 1F2-62209-AH-76) (AD-A050593; USAAMRDL-TR-77-45A-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 01/3

This report presents the design and analysis of propellers applied to mini-remotely piloted vehicles. Modifications to the airfoil data used for predicting the profile drag losses were necessary to account for operation at the low Reynolds number encountered by mini-RPV propellers. Due to the lack of two-dimensional airfoil data, the correction to the drag coefficient is only a function of the design lift coefficient and Reynolds number. Using the revised methods of propeller analysis, six optimum propellers were designed and analyzed for two different RPV's. The analysis showed that improved performance can be obtained with the new designs. A ducted propeller with sufficiently low blade tip clearances was also analyzed. This configuration appears to have superior performance to the open type propellers considered, as well as a potential for reduced noise. Propellers with variable blade angles also appear to offer advantages from both the noise and performance standpoints. GRA

N78-22105# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

USER'S GUIDE. COMPUTER PROGRAM: COMBUSTOR RELIABILITY PREDICTION, VOLUME 3 Final Report, 15 Jun. 1975 - 30 Nov. 1976

B. C. Schlein Wright-Patterson AFB, Ohio AFAPL Oct. 1977 42 p (Contract F33615-75-C-2057; AF Proj. 3066) (AD-A050795; FR-8350-Vol-3; AFAPL-TR-8-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 21/5

This document has been written to serve as a guide to the user of the Combustor Reliability Production Program. This program relates burner crack initiation life and louver lip buckling life to the boundary conditions of compressor exit and turbine

inlet temperature, expressed as a function of time. A description of the failure mode selection, model development and program sensitivity studies was included in the Final Report (Vol. 1) under this contract. Author (GRA)

N78-22106# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.

THE EFFECT OF ROTOR-STATOR AXIAL SPACING ON THE TIME-VARIANT AERODYNAMIC RESPONSE OF A COMPRESSOR STATOR Final Report, 1 Nov. 1976 - 31 Oct. 1977

Sanford Fleeter, Robert L. Jay, and William A. Bennett Dec. 1977 161 p refs

(Contract F49620-77-C-0024)

(AD-A050648; DDA-EDR-9379; AFOSR-78-0165TR) Avail: NTIS HC A08/MF A01 CSCL 21/5

The overall objective of this experimental program was to quantify the effects of rotor-stator axial spacing on the fundamental time-variant aerodynamics relevant to forced response in turbomachinery. This was accomplished in a large-scale, low-speed, single-stage research compressor which permitted two rotor-stator axial spacing ratios representative of those found in advanced design compressors to be investigated. At each value of the axial spacing ratio, the aerodynamically induced fluctuating surface pressure distributions on the downstream vane row, with the primary source of excitation being the upstream rotor wakes, were measured over a wide range of compressor operating conditions. The velocity fluctuations created by the passage of the rotor blades were measured in the non-rotating coordinate system. Data obtained described the variation of the rotor wake with both loading and axial distance from the rotor as parameters. This data also served as a reference in the analysis of the resulting time-variant pressure signals on the vane surfaces. GRA

N78-22107# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.

GENERATION AND SUPPRESSION OF FAN-COMPRESSOR NOISE

S. L. Sarin 1977 22 p refs

(FOK-3-1823) Avail: NTIS HC A02/MF A01

The generation mechanism of fan-compressor noise during the landing phase of an aircraft is dealt with. Various techniques (reduction of interaction tones at the source, flow choking, use of acoustic liners) to suppress this component of total aircraft noise are described. It is concluded that the choice of an optimum liner for the maximum possible suppression demands a predictive capability with regard to liner optimum impedance, and its translation into a real hardware, and liner performance. ESA

N78-22108# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).

LOW NOISE PROPULSION SYSTEM FOR GENERAL AVIATION Final Report on Definition Phase

Bernd Berdrow, Ekkehard Busch, Bernd-Hagen Gruenewald, Siegfried Heine, Ulrich Kraemer, Klaus Zimmermann, Peter Giese, Peter Schmidt-Stiebitz, Peter Limbach, Friedrich Welbhoff et al Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 384 p refs In GERMAN; ENGLISH summary Prepared jointly with DFVLR, Brunswick, Propellerwerk Hoffmann GmbH, Rhein-Flugzeugbau GmbH, Moenchengladbach, Sportavia-Puetzer GmbH, Dahlem, Limbach-Motorenbau, Koenigswinter, and Tech. Hochschule, Aachen

(Contract BMFT-LFK-7551-2)

(BMFT-FB-W-77-23) Avail: NTIS HC A17/MF A01; ZLDI, Munich DM 80,65

The program described is aimed at the development of low noise propulsion systems of up to 200 HP for general aviation. The study is broken down into three stages (definition, production and testing). The objective of the program is a noise reduction of 10 dB(A) in comparison to the 1975 LBA noise economy, derived from standard passenger car engines. A comprehensive noise study on possible propellers (including shrouded propellers) forms the basis for the propeller rpm's required for low noise propulsion systems. The conversion of the high rpm's normal for passenger car engines to the low propeller rpm's required is via gearboxes, which are a fundamental problem dealt with. The solution to the problem is given in the definition stage. Studies on the installation of propulsion systems in existing airframes does not show particular problems. Author (ESA)

N78-22109# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).

AMELIORATION OF VARIOUS COMPONENTS OF A SUBSONIC TRANSPORT AIRCRAFT ENGINE [L'AMELIORATION DES DIFFERENTS COMPOSANTS DE L'INSTALLATION MOTRICE D'UN AVION SUBSONIQUE DE TRANSPORT]

Jean Devriese Assoc. Aeron. et Astronautique de France 1977 21 p In FRENCH Presented at the 13th Intern. Aeron. Congr., Paris, 2-3 Jun. 1977

(AAAF-NT-77-31; ISBN-2-7170-0456-4) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Possibilities to further improve the third generation transport aircraft engines Rolls Royce RB 211, Pratt & Whitney JT 9D, and General Electric CF6/50, notably as regards losses in the thermodynamic cycle, are discussed. The following topics are dealt with: reduction of compressor losses; reduction of turbine losses; mixers and exchangers; and energy saving. ESA

N78-22110# Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.

COST-EFFECTIVENESS ANALYSIS OF THE PROPOSED REVISIONS IN THE EXHAUST EMISSION STANDARDS FOR NEW AND IN-USE GAS TURBINE AIRCRAFT ENGINES BASED ON INDUSTRY SUBMITTALS

Richard S. Wilcox and Richard Munt Dec. 1977 30 p refs (PB-276508/9; AC-77-02) Avail: NTIS HC A03/MF A01 CSCL 21E

Analysis of several control strategies were provided. Those studied were: the control of newly manufactured gas turbine engines in 1981 for HC and CO only; retrofit of in use gas turbine engines in 1985 for HC and CO only; and the control of newly manufactured gas turbine engines in 1984 for HC, CO and NOx. Author

N78-22111# Advisory Group for Aerospace Research and Development, Paris (France).

AERODYNAMICS OF CASCADES

Norbert Scholz Jan. 1978 604 p refs Transl. into ENGLISH from Aerodynamik der Schaufelgitter, West Germany, 1965

(AGARD-AG-220) Avail: NTIS HC A99/MF A01

Physical-phenomenological and the theoretical aspects of two dimensional cascade flows were examined, as well as various experimental techniques and three dimensional flow problems. Author

N78-23023*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NORMAL SHOCK AND RESTART CONTROLS FOR A SUPERSONIC AIRBREATHING PROPULSION SYSTEM

George H. Neiner, Gary L. Cole, and Francis J. Paulovich *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 299-321 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 21E

N78-23024*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTIMAL CONTROL OF A SUPERSONIC INLET TO MINIMIZE FREQUENCY OF INLET UNSTART

Bruce Lehtinen, John R. Zeller, and Lucille C. Geyser *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 323-335 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-22112# Toronto Univ. (Ontario).
A REVIEW AND APPLICATION OF THE EQUIVALENT DETERMINISTIC VARIABLE TECHNIQUE: THE ESTIMATION OF A STOL AIRCRAFT'S RESPONSE TO TURBULENCE
A. B. Markov and L. D. Reid Feb. 1978 57 p refs
(Grants NRC A-7934; AF-AFOSR-3028-76A)
(UTIAS-221; CN-ISSN-0082-5255) Avail: NTIS HC A04/MF A01

The equivalent deterministic variable technique is a method for determining the RMS response of a linear constant coefficient system to random inputs. The mathematical development of this theory is reviewed. The theory was applied to the prediction of the response of a STOL aircraft to low altitude turbulence. The outstanding and limition features of the procedure are discussed from an applications point of view. Author

N78-22113# Boeing Vertol Co., Philadelphia, Pa.
HEAVY LIFT HELICOPTER FLIGHT CONTROL SYSTEM. VOLUME 1: PRODUCTION RECOMMENDATIONS Final Report, Jul. 1971 - Jul. 1975
A. J. Niven Sep. 1977 91 p refs
(Contract DAAJ01-71-C-0840)
(AD-A050618; D301-10322-1; USAAMRDL-TR-77-40A) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report defines the requirements for the Heavy Lift Helicopter (HLH) flight control system. Production recommendations concerning the fly-by-wire mechanization concepts and the stability and control characteristics requiring augmentation are developed. This report constitutes Volume 1 of the overall HLH flight control system study. Associated documents are: Volume 2 - Primary Flight Control System Development and Feasibility Demonstration, and Volume 3 - Automatic Flight Control System Development and Feasibility Demonstration. Volumes 2 and 3 expand the basic requirements set forth in this volume. Author (GRA)

N78-22114# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
OPEN LOOP GUST ALLEVIATION Final Report
Manfred Buchstaller, Johannes Schroeder, Peter Wuest, and Horst Wuennenberg Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1977 113 p refs In GERMAN; ENGLISH summary
(Contract BMFT-LFF-7606-6)
(BMFT-FB-W-77-22) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 23,10

The effectiveness of a simple gust alleviation system to improve ride quality during flights in rough air was studied with emphasis on the reduction of gust effects within the low and medium frequency range. The investigations were based on the data of an improved DO-28 and were carried out for both the open and the closed-loop philosophy. Analog simulations and digital computations were performed. The layout criterion was the reduction of the vertical accelerations due to turbulence. The elevator and the ailerons were used as lift flaps for control inputs. Results show very good effectiveness of both systems within the relevant frequency range. A combination of the open and closed loop principle showed the best possible results. The closed loop layout showed a remarkable result, since a significant gust alleviation can be realized by using the elevator alone. Author (ESA)

N78-23018*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN APPROACH TO THE DETERMINATION OF AIRCRAFT HANDLING QUALITIES USING PILOT TRANSFER FUNCTIONS
James J. Adams and Howard G. Hatch, Jr. *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 199-216 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 01C

N78-23019*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
A FREQUENCY DOMAIN APPROACH TO HANDLING QUALITIES DESIGN
William A. Wolovich *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 217-236 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 01C

N78-23029*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETERMINATION OF OPTIMAL CONTROL USING IMBEDDING OF THE TERMINAL CONDITIONS
Raymond C. Montgomery *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 435-442 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N78-22115*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS FOR MEASURING AN AIRCRAFT'S SPEED AND HEIGHT Patent Application
William R. Young and Charles W. Stump, inventors (to NASA) Filed 9 Mar. 1978 14 p
(NASA-Case-LAR-12275-1; US-Patent-Appl-SN-885065) Avail: NTIS HC A02/MF A01 CSCL 14B

The invention consists essentially of two ground positioned television cameras 11 and 12 separated by a measured distance and placed in line with the projection 13 of the expected path 14 of an aircraft 15. The circuitry is used to start the count on counter 26 when the aircraft passes through the field of view of camera 11 and to stop the count on counter 26 when the aircraft passes through the field of view of camera 12. The resulting count on counter 26 is proportional to the speed of the aircraft. The count on counter 27 starts when the aircraft first enters the field of view of camera 11 and stops when the aircraft leaves the field of view of camera 11. After the speed has been determined the resulting count on counter 27 is proportional to the height of the aircraft. NASA

N78-22116# Transportation Research Board, Washington, D. C.
BIBLIOGRAPHY: AIRPORTS
Oct. 1977 163 p
(Contract DOT-FA76WA-3872)
(AD-A049879/0; FAA-EM-77-15) Avail: NTIS HC A08/MF A01 CSCL 01/5

The bibliography was prepared to illustrate input-output procedures that were proposed for the implementation of an Air Transportation Research Information Service (ATRIS). The proposed subject scope for ATRIS covers 21 areas that range from aircraft to travel and tourism. The subject of airports was selected as the area for initial input to the ATRIS data base from which this bibliography has been produced. The bibliography has 10 chapters on major aspects of airports, including access, environmental impact, planning and design, safety and security, operations, and management. The bibliography contains nearly 800 references that represent initial input to the machine-readable ATRIS data base. The implementation plan calls for extending the data base to full coverage of all subject areas and to provide both on-line and off-line services to the air transport community. A major purpose for the bibliography is to inform ATRIS users of the services that might be provided and through feedback from recipients of the bibliography to learn more about the needs and wants of users of air transport information. Author

N78-22117# Federal Aviation Administration, Washinton, D. C. Office of Aviation System Plans.
ESTABLISHMENT CRITERIA FOR VISUAL APPROACH SLOPE INDICATOR (VASI) Final Report

Jose Roman, Jr. May 1977 42 p refs
(AD-A043785; FAA-ASP-76-2) Avail: NTIS HC A03/MF A01 CSCL 01/5

Revised establishment and discontinuance criteria were developed for visual approach slope indicator (VASI) which provide visual flight rules (VFR) guidance only. Criteria are based upon detailed benefit/cost methodology which takes into account the number of aircraft landings by user class with variations depending upon whether or not the runway is equipped with an instrument landing system. Benefits derived from a VASI are principally in the area of safety which are obtained by improved guidance during final VFR approaches. Revised criteria require that a ratio value be computed for each of the three types of operations (air carrier, air taxi, and general aviation including military). The three ratios are then added to obtain a total ratio value, and this is multiplied by the runway utilization to obtain a net ratio value. If this net ratio value is equal to 1 or greater, then the runway is a candidate for a VASI. In short term, it is estimated that 590 runways now without a VASI will qualify. Over the next ten years, and additional 388 runways are expected to qualify for a VASI.

N78-22118# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soil and Pavements Lab.
DESIGN AND CONSTRUCTION OF CONTINUOUSLY REINFORCED CONCRETE AIRPORT PAVEMENTS Final Report
Gary G. Harvey Aug. 1977 93 p refs
(Contract DOT-FA71WAI-218)
(AD-A049970/7; AEWES-TR-S-77-11; FAA-RD-74-37) Avail: NTIS HC A05/MF A01 CSCL 01/5

Design procedures recommended for immediate use in the construction of continuously reinforced concrete (CRC) airport pavements are presented. The basic physical-mathematical model and applicable analyses are discussed. Thickness design procedures for both new CRC pavements and CRC overlays are presented for both civil and military aircraft. Methods for designing steel reinforcement, construction joints, and terminal treatment systems are included. Author

N78-22119# Acurex Corp., Mountain View, Calif.
ANALYSIS AND DESIGN OF A TWO-STAGE HYBRID LAUNCHER Final Report, 15 Jan. - 30 Jul. 1977
T. J. Dahm and J. D. Watson May 1977 83 p refs
(Contract DNA001-76-C-0407)
(AD-A050702; AD-E300091; TR-77-245(7260); DNA-4334F) Avail: NTIS HC A05/MF A01 CSCL 14/2

This report summarizes the analysis and design of a two-stage hybrid launcher capable of soft launching 12-pound, 4-inch diameter models to 20,000 fps. The design and configuration of explosive drivers to inject high energy hydrogen into the compressor section of a two-stage gun is described. The calculation of ballistic performance is of note. The detailed calculation of inviscid, adiabatic core flow in conjunction with an analysis of launch tube boundary layer growth is used to evaluate heat transfer to the launcher walls. An analysis and design of tungsten and composite thermal liners are presented. Author (GRA)

N78-22120# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
LAKE ERIE INTERNATIONAL JETPORT-MODEL FEASIBILITY INVESTIGATION. REPORT 17-9: RESULTS OF NUMERICAL THREE-DIMENSIONAL WIND-DRIVEN CIRCULATION ANALYSIS FOR THERMALLY STRATIFIED LAKE CONDITIONS
Donald L. Durham and Donald C. Raney Jan. 1978 88 p refs
(AD-A050614; AEWES-MP-H-76-3-9) Avail: NTIS HC A05/MF A01 CSCL 04/2

The wind-driven circulation for thermally stratified lake conditions in a 16-mile by 16-mile nearshore region offshore Cleveland, Ohio, is studied for existing conditions and conditions as modified by a proposed jetport island. A steady-state 12 mph west wind, which produced maximum jetport effects in a previous WES study of the steady-state wind-driven circulation for well-mixed lake conditions in the nearshore region offshore Cleveland, Ohio, was chosen as the wind field for the model study. GRA

N78-22121# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
INCREASING THE FORCE LIMITS OF THE MAGNETIC BALANCE SYSTEM Final Report, 15 Apr. 1976 - 30 Sep. 1977
Eugene E. Covert, Charles W. Haldeman, and Benjamin Ziph Nov. 1977 27 p refs
(Contract DAAG29-76-C-0028)
(AD-A050746; MIT-TR-199; ARO-13897.1-EX) Avail: NTIS HC A03/MF A01 CSCL 14/2

The construction and testing of new motor generator power supplies and filter inductors for use with the magnetic balance system were described. Motor generator output is plus or minus 380 volts with a current limit of plus or minus 300 amps and a power limit of 50 hp. Connected to the lift and drag circuits the supplies were tested up to 144 amperes in drag and 244 amperes in lift. Calculations of the performance of the 200 ampere 1.6 mh inductors as coupling networks were also presented as well as Q = (omega) (L/R) vs frequency measured for the coils. Measured Q at 20 KC was 660. Author

N78-22122# New Jersey State Dept. of Transportation, Trenton. Div. of Research and Development.
PAVEMENT HEATING, 1969-1975 Final Report
Frank Winters and Robert Sasor Feb. 1977 209 p
(PB-276609/5; FHWA/NJ-77/003; Rept-77-003-7722) Avail: NTIS HC A10/MF A01 CSCL 13B

In order to evaluate a roadway heating system which used the energy stored in the earth for snow melting, a 3200 square foot experimental heated pavement was constructed in Trenton, New Jersey. Heat was extracted from the earth by means of a grid of pipes buried 3 to 13 ft. below ground and transferred via an ethylene glycol water solution to pipes embedded in a test pavement. For purposes of comparison, a section of pavement heated by electrical resistance wires was also included as part of the installation. Results of operation indicated that the best snow melting took place on sections of portland cement concrete containing 3/4 inch and 1-1/4 inch wrought iron pipe spaced on 6 inch centers and embedded at a depth of 2 inches. GRA

N78-23020*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
OPTIMAL REGULATOR OR CONVENTIONAL? SETUP TECHNIQUES FOR A MODEL FOLLOWING SIMULATOR CONTROL SYSTEM
Dwain A. Deets *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 237-252 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 14B

N78-23021*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
QUASI-OPTIMAL CONTROL OF A MOVING-BASE SIMULATOR
Elwood C. Stewart *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 253-259 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 14B

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-22123* National Aeronautics and Space Administration, Washington, D. C.
PIONEER VENUS 1 LAUNCH SET FOR MAY 20
9 May 1978 124 p
(NASA-News-Release-78-68; P78-10070) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The launch and cruise phases of both the Pioneer Venus

Orbiter and the Multiprobe spacecraft are covered. Much of the material is also pertinent to the Venus encounter. Author

N78-22124*# ECON, Inc., Princeton, N. J.
CANDIDATE SUBSTANCES FOR SPACE BIOPROCESSING METHODOLOGY AND DATA SPECIFICATION FOR BENEFIT EVALUATION Final Report
13 Jan. 1978 102 p
(Contract NASw-3047)
(NASA-CR-156290; ECON-77-265-1) Avail: NTIS HC A06/MF A01 CSCL 22A

Analytical and quantitative economic techniques are applied to the evaluation of the economic benefits of a wide range of substances for space bioprocessing. On the basis of expected clinical applications, as well as the size of the patient that could be affected by the clinical applications, eight substances are recommended for further benefit evaluation. Results show that a transitional probability methodology can be used to model at least one clinical application for each of these substances. In each recommended case, the disease and its therapy are sufficiently well understood and documented, and the statistical data is available to operate the model and produce estimates of the impact of new therapy systems on the cost of treatment, morbidity, and mortality. Utilizing the morbidity and mortality information produced by the model, a standard economic technique called the Value of Human Capital is used to estimate the social welfare benefits that could be attributable to the new therapy systems. Author

N78-22125*# Cornell Univ., New York. Rogosin Kidney Center.
SEPARATION OF LYMPHOCYTES BY ELECTROPHORESIS UNDER TERRESTRIAL CONDITIONS AND AT ZERO GRAVITY Summary Report, 5 Jan. 1976 - 4 Jan. 1977
Albert L. Rubin Nov. 1977 87 p refs
(Contract NAS8-31513)
(NASA-CR-150669) Avail: NTIS HC A05/MF A01 CSCL 22A

Electrophoretic mobility (EPM) of human peripheral lymphocytes were examined with the following objectives: To determine differences in EPM of lymphocytes under immuno-stimulated and immuno-suppressed states. To define the conditions necessary for the separation of lymphocyte sub-populations in normal and pathological conditions; To investigate immunological active, charged chemical groups on lymphocyte surfaces; and to investigate pathophysiological mechanisms of immune responsiveness, as reflected by alterations in EPM. To evaluate the potential of lymphocyte electrophoresis as: (1) a means of monitoring the immune status of kidney transplant recipients, (2) in predicting the outcome of kidney transplants, and (3) as a method for separation of lymphocyte sub-populations, the EPM was studied for unfractionated human peripheral lymphocytes and of populations enriched with T and 'B' cells from normal adults, hemodialysis patients and kidney transplant recipients. Author

N78-22126# Committee on Science and Technology (U. S. House).
WORLD-WIDE SPACE ACTIVITIES: NATIONAL PROGRAMS OTHER THAN THE UNITED STATES AND SOVIET UNION; INTERNATIONAL PARTICIPATION IN THE US POST-APOLLO PROGRAM; INTERNATIONAL COOPERATION IN SPACE SCIENCE, APPLICATIONS AND EXPLORATION; ORGANIZATION; AND IDENTIFICATION OF MAJOR POLICY ISSUES
Washington GPO 1977 638 p refs Rept. for the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 1st Sess., Sept. 1977 Prepared by the Library of Congr., Sci. Policy Res. Div.
(GPO-85-503) Avail: SOD HC

The involvement of 140 nations in space research, exploration, applications, and utilization is detailed with emphasis on nations which have developed a national launch capability or national launch facilities. The cooperative efforts of the European Organization for Space are included. Communication satellite programs which are international in scope are described along with international involvement in the various global observation satellite programs, including meteorological, earth resources, and oceanographic satellite programs. Specific topics discussed relating to international cooperation in space exploration include: the policy and philosophy surrounding international cooperative space activities; radio frequency allocation in space communications; registration of space objects; direct broadcast satellites; a treaty for exploration and utilization of the moon and its resources; and utilization of space applications by developing nations. International organizations which are primarily concerned with space, its utilization, and applications are briefly described. J.M.S.

N78-22127# Towlson Consultants and Co., Fauersham (England).
AN ARC IMAGE FURNACE FOR SPACE PROCESSING APPLICATIONS. VOLUME 1: FURNACE DESIGN AND SPECIFICATIONS Final Report
P. G. Towlson, L. C. Laming, P. H. G. Allen, D. Pedder, G. W. H. Wollard, and T. M. Hunter Paris ESA Apr. 1977 248 p refs Prepared jointly with BAC, Filton, Engl. 2 Vol.
(Contract ESA-SC/80-HQ)
(ESA-CR(P)-1025-Vol-1) Avail: NTIS HC A11/MF A01

A feasibility study was made of an arc image furnace for Spacelab. The system design consists of four component parts: the flux generator unit, the flux enclosure, the electrical power supply and control system, and the thermal radiation calorimeter system. Various possible interrelations of one or more flux generator units with enclosures were considered, and a two flux generator system was selected with 2,500 watt xenon bulbs using a collection mirror developed by NASA. Tests showed that the full system would meet the requirements and demonstrated the feasibility of the furnace as an operating unit. Mechanical and electrical compatibility with Spacelab was also investigated. ESA

N78-22128# Towlson Consultants and Co., Fauersham (England).
AN ARC IMAGE FURNACE FOR SPACE PROCESSING APPLICATIONS. VOLUME 2: SPACELAB INSTALLATION Final Report
P. Braund and R. W. Parker Paris ESA Apr. 1977 98 p Prepared jointly with BAC, Filton, Engl. 2 Vol.
(Contract ESA-SC/80-HQ)
(ESS/SS-792; ESA-CR(P)-1025-Vol-2) Avail: NTIS HC A05/MF A01

The accommodation of the arc image furnace and its ancilliary equipment into Spacelab was investigated. A study was made of the Spacelab facilities and constraints were made with regard to the demands on furnace design. The high power consumption of the furnace places particularly stringent demands on the power supply and environmental control subsystems of Spacelab. The most suitable location for the experiment is considered to be in the equipment racks and a support structure has been designed with regard to experiment operations, accessibility, and accommodation of ancilliary equipment. Consideration has been given to aspects of monitoring and control, operational requirements, safety, and a qualification program. ESA

N78-22129# Max-Planck-Institut fuer Biochemie, Martinsried bei Muenchen (West Germany). Abt. Biochemische Arbeitsmethoden.
ELECTROPHORESIS EXPERIMENT MA-014 IN THE APOLLO SOYUZ TEST PROJECT. PART 1: SCIENTIFIC RESULTS Final Report
Kurt Hannig, Hans Wirth, Dieter Leihener, Roland Loeser, and Werner Dersch Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1977 32 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-471) 3 Vol.
(Contracts BMFT-WRT-2074-C; GfW-RV-21-B-18/73)
(BMFT-FB-W-77-02) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 6,75

Results are presented of the free flow electrophoresis experiment on cell materials carried out during the Apollo Soyuz Test Project. For physical reasons (gravitation dependent thermoconvection and sedimentation) the ground application of the method is restricted with regard to throughput (liquid flow rate) and dissolution (selectivity). In a state of weightlessness as in space, both values can be improved. This is confirmed by the electrophoresis experiment used in the Apollo Soyuz Test Project for separation of four biological samples (cell combinations). Author (ESA)

N78-22130# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.
ELECTROPHORESIS EXPERIMENT MA-014 IN THE APOLLO SOYUZ TEST PROJECT. PART 2: TECHNICAL ASPECTS Final Report
Erhard Schoen, Guenter Dorl, and Hans Juergen Lemke Bonn Bundesmin fuer Forsch. u. Technol. Sep. 1977 40 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-472) 3 Vol.
(Contracts BMFT-SLN-7750; GfW-RV-21-V3/74) (BMFT-FB-W-77-03; MBB-URV-87(75)) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 8,40

The design and onboard operation of the free flow electrophoresis experiment in the Apollo Soyuz Test Project are outlined. The apparatus has a weight of 26 kg and a power consumption of 300 W. It was used to record pherograms for a total of four biological samples. The experiment sequence was automatically controlled. Author (ESA)

N78-22131# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.
ELECTROPHORESIS EXPERIMENT MA-014 IN THE APOLLO SOYUZ TEST PROJECT. PART 3: FUTURE APPLICATIONS Final Report
Erhard Schoen, Guenter Dorl, and Hans Juergen Lemke Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1977 123 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-473) 3 Vol.
(Contracts BMFT-SLN-7751; DFVLR-BPT-01-QV-365-V22) (BMFT-FB-W-77-04; MBB-URV-93(76)) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 25,85

In view of future mission objectives, the Apollo Soyuz Test Project (ASTP) configuration of the experiment does not appear suited for use in Spacelab. Instead, an experiment to be flown aboard sounding rockets (TEXUS) is presented which serves to verify the ASTP results and to test components of the Spacelab equipment. On the basis of this ASTP configuration, and taking into account the necessary modifications and required performance characteristics, and electrophoresis equipment suited for use in Spacelab was conceived, together with a schedule and cost estimate for the manufacture of the components. A configuration to be used on the pallet of the shuttle (without Spacelab) is considered. Such a use is of interest because of the considerably higher number of launches possible and the lower costs of launching. Owing to the absence of the Spacelab periphery (atmosphere, power supply, computer, etc.) both the cost of production of such equipment and the cost for specimen analysis are substantially higher than the comparable costs related to the Spacelab configuration, so that it is recommended to abandon this possibility. Author (ESA)

N78-22255 Joint Publications Research Service, Arlington, Va.
ZAYTSEV COMMENTS ON FUTURE ORBITAL COMPLEXES
Yu. Zaytsev *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 54-56 Transl. into ENGLISH from Trud (Moscow), 21 Mar. 1978 p 4 (For availability see N78-22249 13-31)
Avail: Issuing Activity

N78-22623 European Space Agency, Paris (France).
GENERAL LIFE SCIENCE FACILITIES FOR SPACELAB MISSIONS UNDER DESIGN IN EUROPE
G. Seibert *In its* Life-Sci. Res. in Space Sep. 1977 p 37-43 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22652 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
STANDARD EQUIPMENT FOR PHYSIOLOGICAL EXPERIMENTS IN WEIGHTLESSNESS
G Brandau, J. C. Dietrich, B. Hofer, H. U. Knoop, H. Schaus (W.C. Heraeus GmbH), H. Schienle (W.C. Heraeus GmbH), H. Sinn (Heraeus-Christ GmbH), and E. Roedel (Heraeus-Christ GmbH) *In* ESA Life-Sci. Res. in Space Sep. 1977 p 235-244 ref (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-22132 Stanford Univ., Calif.
OPTIMAL TRANSFER BETWEEN CLOSE NEAR-CIRCULAR ORBITS Ph.D. Thesis
Jean Albert Kechichian 1977 246 p
Avail: Univ. Microfilms Order No. 78-02179

A nonlinear analysis was carried out for the optimal transfer between close near circular non-coplanar orbits. With the aid of a generalized Jacobi test, it was established that the optimal transfer requires at most three impulses. The analysis further reveals that, in many cases, two different potentially optimal transfer strategies are obtainable, their cost in fuel being identical according to the linear analysis. Higher order cost corrections were obtained, and the optimal strategy can thereby be selected. An iterative scheme is described differing in detail according to the regions of the linear analysis of Marec and Edelbaum; the object of this scheme is to converge rapidly on each potentially optimal transfer strategy for a given change of orbit. The scheme is greatly simplified by not having to consider more than three impulses. Dissert. Abstr.

N78-22133*# Aerospace Corp., El Segundo, Calif.
ANALYSIS OF SATELLITE-TO-SATELLITE TRACKING (SST) AND ALTIMETRY DATA FROM GEOS-C
L. Wong, E. Matthews, and W. Downs Apr. 1978 77 p refs (Contract NAS6-2508)
(NASA-CR-141438) Avail: NTIS HC A05/MF A01 CSCL 22A

Radar altimetry and satellite-to-satellite (SST) range and range rate tracking measurements were used to infer the exterior gravitational field of the earth and the structure of the geoid from GEOS-C metric data. Under the SST analysis, a direct point-by-point estimate of gravity disturbance by means of a recursive filter with backward smoothing was attempted but had to be forsaken because of poor convergence. The adopted representation consists of a more or less uniform grid of discrete masses at a depth of approximately 400 km from the earth's surface. The layer is superimposed on a spherical harmonics model. The procedure for smoothing the altimetry and inferring the fine-structured gravity field over the Atlantic test area is described. The local disturbances are represented by means of a density layer. The altimeter height biases were first estimated by a least squares adjustment at orbital crossover points. After taking out the bias, long wavelength contributions from GEM-6 as well as a calibration correction were subtracted. The residual heights were then represented by a mass distribution beneath the earth's surface. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N78-22134*# Hamilton Standard, Windsor Locks, Conn.
INSTRUMENTATION, CONTROL AND DATA MANAGEMENT FOR THE MIST (MODULAR INTEGRATED UTILITY SYSTEM) FACILITY
V. A. Celino [1977] 128 p
(Contract NAS9-14674)
(NASA-CR-151708; JSC-13957) Avail: NTIS HC A07/MF A01 CSCL 14B

An appendix providing the technical data required for computerized control and/or monitoring of selected MIST subsystems is presented. Specific computerized functions to be performed are as follows: (1) Control of the MIST heating load simulator and monitoring of the diesel engine generators' cooling

system; (2) Control of the MIST heating load simulator and MIST heating subsystem including the heating load simulator; and (3) Control of the MIST air conditioning load simulator subsystem and the MIST air conditioning subsystem, including cold thermal storage and condenser water flows. Author

N78-23039# European Space Agency, Paris (France).
IMPROVEMENT OF THE CHARACTERIZATION OF THE CACTUS ACCELEROMETER ON THE BASIS OF RESULTS OBTAINED DURING THE SCIENTIFIC OPERATIONAL PHASE
Jacques Beaussier and Anne-Marie Mainguy *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 87-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 255-257 Original report in FRENCH previously announced as A77-50442 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-22135 Communications Research Centre, Ottawa (Ontario). Space Systems Directorate.
CANADIAN AERONAUTICAL SATELLITE TESTS USING THE ATS-6 SATELLITE, 1974-1975
J. H. Chinnick and D. Burtt Feb. 1978 103 p refs
(CRC-1308) Copyright. Avail: Issuing Activity

An extensive series of tests was conducted using the ATS-6 satellite to compare the performance of four voice modulation techniques and two antenna systems installed in an airborne terminal. The voice techniques were narrowband frequency modulation, pulse duration encoding/Phase Shift Keying (PSK) modulation, delta encoding/PSK modulation, and a technique based upon the transmission of the PSK modulated zero crossing transitions of the audio signal. The tests were conducted under varying conditions of carrier to noise dénsity ratio and carrier to diffuse multipath ratio. The delta and zero crossing techniques were found to give the best intelligibility, and none of the channel units indicated a sensitivity to the multipath signal. Author

N78-22136*# Aerojet Electrosystems Co., Azusa, Calif.
SPACE STATION THERMAL CONTROL SURFACES. VOLUME 1: INTERIM REPORT Interim Report, 4 Aug. 1977 - 4 Feb. 1978
C. R. Maag and J. M. Millard Mar. 1978 222 p refs 2 Vol. (Contract NAS8-32637)
(NASA-CR-150667; Rept-5666-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 05A

The U.S. space program goals for long-duration manned missions place particular demands on thermal-control systems. The objective of this program is to develop plans which are based on the present thermal-control technology, and which will keep pace with the other space program elements. The program tasks are as follows: (1) requirements analysis, with the objectives to define the thermal-control-surface requirements for both space station and 25 kW power module, to analyze the missions, and to determine the thermal-control-surface technology needed to satisfy both sets of requirements; (2) technology assessment, with the objectives to perform a literature/industry survey on thermal-control surfaces, to compare current technology with the requirements developed in the first task, and to determine what technology advancements are required for both the space station and the 25 kW power module; and (3) program planning that defines new initiative and/or program augmentation for development and testing areas required to provide the proper environment control for the space station and the 25 kW power module. Author

N78-22137*# Aerojet Electrosystems Co., Azusa, Calif.
SPACE STATION THERMAL CONTROL SURFACES. VOLUME 2: LITERATURE SEARCH Interim Report, 4 Aug. 1977 - 4 Feb. 1978
C. R. Maag and M. T. Grenier Mar. 1978 410 p refs 2 Vol. (Contract NAS8-32637)
(NASA-CR-150668; Rept-5666-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 05A
For abstract, see N78-22136.

N78-22138# Military Academy, West Point, N. Y. Dept. of Engineering.
A MARKOVIAN APPROACH TO MISSILE SYSTEMS TEST SEQUENCING Final Report
Allen F. Grum, Terry A. Breshick, and Bruce F. Rogers (Army Operational Test and Evaluation Agency, Falls Church, Va.) Oct. 1977 22 p
(AD-A050848) Avail: NTIS HC A02/MF A01 CSCL 14/2

Given a new missile system, a set of required capabilities, and a limited set of testing resources, one desires to verify mission accomplishment or nonaccomplishment as efficiently as possible. There are various test environments that can be used ranging from easy tests that yield small amounts of information, to difficult tests that are more prone to failure but can provide more extensive information. This paper uses a Markovian model to investigate optimal test sequencing with a highest expected reward decision criterion. GRA

N78-22139# European Space Agency, Paris (France).
LITHERGOL DUAL PROPULSION FOR CRUISE MISSILES
Hendrik R. Lips and Robert H. Schmucker Feb. 1978 47 p refs Transl. into ENGLISH of 'Lithergole Dualantriebe fuer Marschflugkoerper', DFVLR, Hardthausen, West Ger. Report DLR-IB-76-7, Sep. 1976 Original report in GERMAN previously announced as N78-18122
(ESA-TT-446; DLR-IB-76-7) Avail: NTIS HC A03/MF A01

Construction, functioning, and specific characteristics of lithergol propulsive systems - rockets and air breathing engines - in missiles are reviewed. It is shown that for cruise missiles a variety of combination propulsive engines are possible. Considering aspects such as performance, simplicity, controllability, and combination possibilities, it is concluded that none of these aspects will pose insurmountable problems. ESA

N78-23014*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATIONS OF THE HYBRID COORDINATE METHOD TO THE TOPS AUTOPILOT
G. E. Fleischer *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 127-156 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 22B

N78-23015*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STEERING LAWS FOR DOUBLE-GIMBAL CONTROL-MOMENT GYROS
Stephen W. Winder *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 157-173 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 22B

N78-23042# Joint Publications Research Service, Arlington, Va.
COMMENTARY ON POWDER SOURCES, INCLUDING NUCLEAR, FOR SATELLITES
Laszlo Jeki *In its* Transl. on Eastern Europe (JPRS-70992) 21 Apr. 1978 p 9-12 Transl. into ENGLISH from Magy. Hirlap (Budapest), 11 Feb. 1978 p 6 (For availability see N78-23040 13-99)
Avail: NTIS HC A04/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N78-22140*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
MISSION CONTROL CENTER (MCC) SYSTEM SPECIFICATION FOR THE SHUTTLE ORBITAL FLIGHT TEST (OFT) TIMEFRAME
24 Mar. 1978 320 p Prepared in cooperation with IBM, Houston, Tex.
(Contracts NAS9-15014; NAS9-14350)
(NASA-CR-151687; JSC-10013B) Avail: NTIS HC A14/MF A01 CSCL 22D

The Mission Control Center Shuttle (MCC) Shuttle Orbital Flight Test (OFT) Data System (OFTDS) provides facilities for flight control and data systems personnel to monitor and control the Shuttle flights from launch (tower clear) to rollout (wheels stopped on runway). It also supports the preparation for flight (flight planning, flight controller and crew training, and integrated vehicle and network testing activities). The MCC Shuttle OFTDS is described in detail. Three major support systems of the OFTDS and the data types and sources of data entering or exiting the MCC were illustrated. These systems are the communication interface system, the data computation complex, and the display and control system. Author

N78-22141*# TRW Defense and Space Systems Group, Houston, Tex. Systems Engineering and Analysis Dept.
PRELIMINARY DESIGN OF AN ORBITER/IUS SEPARATION SEQUENCE
S. W. Wilson 7 Mar. 1978 61 p refs
(Contract NAS9-14723)
(NASA-CR-151696; TRW-28415-H006-R0-00) Avail: NTIS HC A04/MF A01 CSCL 22B

An orbiter/IUS separation sequence to satisfy the assumed requirements of Shuttle Flight 8 was defined for the purpose of gaining an insight into the flight design software requirements. The key to economical and effective flight design for orbiter/IUS proximity operations is considered to be the capability for rapid and accurate generation of graphical displays that will facilitate not only decision making on the part of the designer, but also lucid documentation of rationale and the resulting design features. The data indicate that (1) an OMS burn is required to attain the necessary velocity without subjecting the IUS and its payload to undue plume impingement, and (2) a departure trajectory that places the orbiter above and behind the IUS at SRM ignition time is preferred over the alternative which would place it below and ahead. Author

N78-22142*# Vought Corp., Dallas, Tex.
SPACE SHUTTLE I-TUBE RADIATOR TESTING AT JOHNSON SPACE CENTER, MAY 1976, VOLUME 1 Final Report
P. B. Scheps 23 Dec. 1976 94 p refs
(Contract NAS9-14907)
(NASA-CR-151679; T169-65-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 22A

During the two weeks of thermal vacuum testing a representative forward panel was successfully operated in a variety of simulated environmental conditions. Performance limits for both high and low load operations were established. Confidence in the stable operation of the panel throughout its typical operating range was verified by the testing, and design studies were conducted to analyze the effects of the payload bay door, and the panel deployment angle, on performance. Author

N78-22143*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPACE SHUTTLE ORBITER TRIMMED CENTER-OF-GRAVITY EXTENSION STUDY. VOLUME 4: EFFECTS OF CONFIGURATION MODIFICATIONS ON THE AERODYNAMIC CHARACTERISTICS OF THE 139B ORBITER AT MACH 20.3
William I. Scallion and David R. Stone Mar. 1978 119 p refs
(NASA-TM-X-72661) Avail: NTIS HC A06/MF A01 CSCL 22A

Force tests were conducted at Mach 20.3 to determine the effect of several forebody, wing-fillet, and canard modifications on the hypersonic trim capability of a 139B Space Shuttle Orbiter model. Force and moment data were obtained at angles of attack of 10 deg to 54 deg at zero sideslip angle and at a Reynolds number of 1,900,000 based on body length. The results indicated that wing-fillet and canard modifications would increase the allowable forward trimmed center-of-gravity capability by as much as 3.0 percent of the body length. Author

N78-22144# European Space Agency, Paris (France).
USAP: A UNIVERSAL STANDARDIZED PROPULSION PLATFORM FOR THE TRANSPORT OF SPACELAB PAYLOADS
Detlef Manski, Joachim Nitsch, and Stanley G. Rosen Feb. 1978 28 p refs Transl. into ENGLISH of 'USAP - Eine universelle standardisierte Antriebsplattform zum Transport von Spacelab-Nutzlasten', DFVLR, Lampoldshausen, West Ger. Report DLR-IB-456/75-9, 20 Nov. 1975 Original report in GERMAN previously announced as N78-18123
(ESA-TT-455; DLR-IB-456/75-9) Avail: NTIS HC A03/MF A01

A proposal is presented for a Spacelab payload transportation system to accommodate a number of Spacelab experiments requiring an auxiliary propulsion system to carry out missions outside Spacelab's near vicinity. A universally deployable platform is proposed for this purpose allowing transportation of single experiment units as well as the transport and positioning of satellites. ESA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N78-22145# Federal Electric Corp., Vandenberg AFB, Calif.
TELEMETRY SYSTEMS CALIBRATION AND VALIDATION HANDBOOK Final Report, 1 Jan. 1975 - 15 Sep. 1977
R. G. Streich and G. Johnson 15 Sep. 1977 247 p
(Contract F04703-77-C-0111)
(AD-A050503; PA100-77-40; SAMTEC-TR-78-56) Avail: NTIS HC A11/MF A01 CSCL 09/6

This handbook is prepared to provide informative material for aerospace engineers, range technical operators, and planners who are concerned with telemetry systems calibration and validation. Specifically, it is designed to serve as a reference and source document for delineation and standardization of calibration procedures and validation techniques as they apply to the Space and Missile Test Center (SAMTEC) telemetry systems. Author (GRA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-22146*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STRUCTURAL MEMBERS, METHOD AND APPARATUS Patent Application
Jack A. Kinzler, inventor (to NASA) Filed 4 Apr. 1978 50 p (NASA-Case-MSC-16217-1; US-Patent-Appl-SN-893383) Avail: NTIS HC A03/MF A01 CSCL 22A

A lightweight structural member suitable as trusses to be used in the assembly of large structures in space (e.g., solar

power satellite) is described, together with a compact, fully automated machine for manufacturing such members in a space environment from compactly stowed sheet material. The rigid, triangular truss is formed of initially flexible, relatively thin rolled sheet material, and includes three parallel tubular columns formed from a strip of sheet material closed upon itself by helical winding. The structural member takes advantage of the space environment, such as low gravitational forces, to utilize construction materials, such as flexible sheet material; and solves the problems of the constraints of manufacturing large space structures such as limited capability for transportation of materials, and stowage of greatest amount of raw material in the most compact form, etc. NASA

N78-23011*# National Aeronautics and Space Administration. Manned Spacecraft Center, Cape Canaveral, Fla.
DESIGN DEVELOPMENT OF THE APOLLO LUNAR MODULE
Kenneth L. Cox *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 1-62 refs Presented at the Case Studies in System Control Workshop, Colorado Univ., 4 Aug. 1969; sponsored by the IEEE Group on Autom. Control (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 22B

N78-23012*# National Aeronautics and Space Administration. Manned Spacecraft Center, Cape Canaveral, Fla.
DESIGN DEVELOPMENT OF THE APOLLO COMMAND AND SERVICE MODULE THRUST VECTOR ATTITUDE CONTROL SYSTEMS
William H. Peters *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 63-82 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 22B

N78-23013*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBITING ASTRONOMICAL OBSERVATORY (OAO-A2) STABILIZATION AND CONTROL SUBSYSTEM
Thomas E. Huber *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 83-125 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N78-22147# European Space Research and Technology Center, Noordwijk (Netherlands).
COMPREHENSIVE REPORT ON THE HORIZON CROSSING INDICATOR FLOWN ON ESRO-4
A. S. Menardi, Roberta BaldassiniFontana (Officine Galileo), Giorgio DeVidi (Officine Galileo), and M. J. Brewer (BAC, Bristol, Engl.) Paris ESA Nov. 1977 215 p refs
(ESA-TR-15) Avail: NTIS HC A10/MF A01

A horizon crossing indicator (HCI) which was flown as a technological experiment on the European satellite ESRO-4 provided useful data from launch (Nov. 21, 1972) until re-entry (April 15, 1974). The various phases of the HCI project are described: development, qualification, integration into the spacecraft, launch, in-flight operation, and analysis of the data. Particular attention is given to the optimization process applied in the definition of the optical parameters of the sensor and to the Kalman filtering approach employed in the evaluation of the overall performance of the sensor and of its accuracy.
Author (ESA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-22148*# Texas A&I Univ., Kingsville.
INVESTIGATION OF THE BURNING CONFIGURATION OF A COAXIAL INJECTOR IN A COMBUSTION CHAMBER
J. OHara Feb. 1978 26 p refs
(Grant NsG-3112)
(NASA-CR-135383) Avail: NTIS HC A03/MF A01 CSCL 21H

An analytical investigation was made into the stability of the burning configuration of a single coaxial injector surrounded by similar injectors. The stability criteria was based on an average pressure difference along the boundaries of the adjacent stream tubes as calculated using Spaulding's numerical method. The results indicate qualitatively that there is a tendency for the injectors to have different burning configurations. It is believed that the configuration achieved is random, however once the burning configuration is established, it is believed to persist.
Author

N78-22149*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CLOSED LOOP SOLAR ARRAY-ION THRUSTER SYSTEM WITH POWER CONTROL CIRCUITRY Patent Application
Robert P. Gruber, inventor (to NASA) Filed 29 Mar. 1978 20 p
(NASA-Case-LEW-12780-1; US-Patent-Appl-SN-891370) Avail: NTIS HC A02/MF A01 CSCL 21C

A solar array-ion thruster system is described which includes a power control circuit that permits use of the thruster itself in operating the solar array at the maximum power point. The power control circuit, connected between the solar array and the ion thruster and receiving voltage and current signals from the former, multiplies the voltage and current signals together to produce a power signal which is differentiated with respect to time. The differentiator output is detected by a zero crossing detector and, after suitable shaping, the detector output is phase compared with a clock in a phase demodulator. An integrator receives no output from the phase demodulator when the operating point is at the maximum power point, but is driven toward the maximum power point for non-optimum operation. A ramp generator provides minor variations in the beam current reference signal produced by the integrator in order to obtain the first derivative of power. NASA

N78-22150*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A RETRACTABLE ENVIRONMENTAL SEAL Patent Application
Joseph R. Dettling, inventor (to NASA) (United Technologies Corp., East Hartford, Conn.) Filed 29 Mar. 1978 15 p Sponsored by NASA
(NASA-Case-MFS-23646-1; US-Patent-Appl-SN-891372) Avail: NTIS HC A02/MF A01 CSCL 11A

A retractable environmental seal for use in sealing the opening of the exit cone for a rocket nozzle was devised. The seal comprises a diaphragm like cover having a central region adapted to be seated in sealing relation with the periphery of the opening. It is characterized by radially extended failure zones for facilitating a pressure induced rupture of the cover. A plurality of angularly spaced tension springs is connected with the peripheral portion of the cover for retracting fractured segments of the cover from the opening subsequent to a pressure induced rupture. NASA

N78-22151# Aerojet Liquid Rocket Co., Sacramento, Calif.
FLAME TEST VEHICLE 1976 FLIGHT TEST SERIES Final Report, Jul. 1975 - Mar. 1977
James R. Fryer Feb. 1977 144 p
(Contract DNA001-74-C-0266)
(AD-A050764; AD-E300098; ALRC-FR2877-03; DNA-4222F)

Avail: NTIS HC A07/MF A01 CSCL 19/7

The FLAME vehicle was designed as an inexpensive test vehicle to subject various reentry nosetip experiments to ICBM-type reentry environments. The vehicle is a two-stage solid rocket that is dropped from an F-4 aircraft, allowed to coast for a predetermined time, and then fired toward earth at a predetermined angle, thus reaching the experiment environment at the end of second-stage burn. Two such test flights took place in early 1976 at the Tonopah Test Range, placing the total number of flights to date at eight. The vehicle performed as expected on all but two flights; the first stage motor in each case experiencing a nozzle failure. The failure mode was ultimately corrected with the last two flights being successful. The test results indicate the vehicle has met all its objectives relative to performance, versatility, quick reaction, and low cost.

Author (GRA)

N78-22152# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.

LGM-30B, STAGE 2 DISSECTED MOTORS Semiannual Test Report

Neal M. Hansen Dec. 1977 188 p

(AD-A050566; MANCP-384(77)) Avail: NTIS MF A01 CSCL 21/8

This report contains test results from propellant and insulation materials obtained from three Minuteman Stage 2 dissected motors and their corresponding propellant cartons. Testing was performed in accordance with Service Engineering General Test Directive GTD -2 Dissect dated 28 June 1974 and Project M83258C. Statistical analysis includes data from both inner (ANP 2864) and outer (ANP 2862) propellant from the dissected motors and where available, associated propellant cartons. A computer program was utilized to test for common populations of individual dissected motors. Linear regression plots using unique symbols to identify the different relationships between motor and carton data were used to establish general trends. Where a change has taken place and where comparisons could be made, the majority of the regression trend lines are flatter. Therefore, the data are not exceeding the previous sigma limitations. In addition, as more specimens are tested, the trends become more realistic. Most of the test specimens were prepared and tested in the axial orientation, that is, parallel to the longitudinal axis of the motor from which specimens were obtained.

Author (GRA)

N78-22153# European Space Agency, Paris (France).

HYBRID PROPULSIVE SYSTEMS: TECHNOLOGY AND APPLICATION

Robert H. Schmucker and Hendrik R. Lips Feb. 1978 102 p refs Trans. into ENGLISH of 'Hybridtriebwerke: Technol. u. Anwend.', DFVLR, Lampoldshausen, West Ger. Report DLR-IB-456-76/11, 1977 Original report in GERMAN previously announced as N78-18126

(ESA-TT-448; DLR-IB-456-76/11) Avail: NTIS HC A06/MF A01

Hybrid rocket engines comprise a wide range of possible propulsion systems that include the classical lithergolic engines with solid fuels and liquid oxidizers, air-breathing hybrid engines, and even, considering the term in its widest sense, solid fuel engines with liquid injection. Various constructional forms are described. The characteristics and properties of these engines are compared with those of solid and liquid fuel propulsion units and their fields of application discussed with the help of examples already constructed. A performance comparison of the various types of engines was obtained by considering a number of different propellant combinations and their specific impulses. The description of the combustion and regression processes contains a summary of experimentally observed ablation phenomena, theoretical regression analyses, and a comparison of the regression behavior with that of solid fuel rocket engines. This is followed by a review of the internal ballistic aspects, including ignition, quasi-steady operating point, working point, and thrust variation. The various essential elements of a hybrid engine and the necessary technology - injection head, propellant grain, mixing devices are also discussed. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-22154*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SYNTHESIS OF MULTIFUNCTION TRIARYLTRIFLUOROETHANES Patent Application

William P. Kray (Talladega Coll., Ala.) and Robert W. Rosser, inventors (to NASA) (Talladega, Coll., Ala.) Filed 30 Mar. 1978 17 p Sponsored by NASA

(NASA-Case-ARC-11097-1; US-Patent-Appl-SN-891872) Avail: NTIS HC A02/MF A01 CSCL 07C

New 1,1,1-triaryl 2,2,2-trifluoro ethanes in which the aryl radicals carry one or more substituents, were prepared by condensing trifluoro acetophenones with substituted aromatic compounds in the presence of catalytic quantities of trifluoro methyl sulfonic acid. The reaction can be carried out under reflux in toluene or, for strikingly better results in certain cases, reactants are simply stirred at room temperature for about 24 to 48 hours. NASA

N78-22155*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SYNTHESIS OF MULTIFUNCTION TRIARYLTRIFLUOROETHANES Patent Application

William P. Kray (Talladega Coll., Ala.) and Robert W. Rosser, inventors (to NASA) (Talladega Coll., Ala.) Filed 30 Mar. 1978 10 p Sponsored by NASA

(NASA-Case-ARC-11097-2; US-Patent-Appl-SN-891875) Avail: NTIS HC A02/MF A01 CSCL 07C

The 1,1,1-triaryl 2,2,2-trifluoro ethanes, in which the aryl radicals have nitrogen containing substituents such as the amino, nitrile, and acetamido groups, were prepared by the acid catalyzed condensation of trifluoro acetophenones with aromatic substrates containing amino groups. The amino groups may then be converted to nitriles, acetamides, and other derivatives by standard procedures. The products obtained may be used as monomers or as crosslinking agents in polymer formation. NASA

N78-22156*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CATALYSTS FOR IMIDE FORMATION FROM AROMATIC ISOCYANATES AND AROMATIC DIANHYDRIDES Patent Application

Salvatore Riccitiello, Paul M. Sawko, and Carlos A. Estrella, inventors (to NASA) Filed 24 Feb. 1978 16 p

(NASA-Case-ARC-11107-1; US-Patent-Appl-SN-883961) Avail: NTIS HC A02/MF A01 CSCL 07C

This invention relates to the use of metal salts of caprylic (octoic) acid for catalyzing the formation of imide linkages by the reaction of aromatic tetracarboxylic acid dianhydrides with aromatic polyisocyanates. The preferred catalysts are stannous, ferric and aluminum octoates. The reaction can be carried out in one operation, i.e., by placing all the ingredients in a mold and heating at a suitable temperature to obtain a foamed product. Alternatively and preferably, a prepolymer is allowed to form between the reactants, with loss of carbon monoxide equal to about half the theoretical quantity that can be liberated by complete reaction of the ingredients. This prepolymer is then placed in a mold and heated to form the final polyimide foam product. The product has outstanding thermal and fire performance, as shown by burn-through time and flame spread characteristics. NASA

N78-22157*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IN SITU SELF CROSS-LINKING OF POLYVINYL ALCOHOL BATTERY SEPARATORS Patent Application

Warren H. Philipp, L. C. Hsu, and D. W. Sheibley, inventors (to NASA) Filed 19 Apr. 1978 13 p

(NASA-Case-LEW-12972-1; US-Patent-Appl-SN-897829) Avail: NTIS HC A02/MF A01 CSCL 07C

The method disclosed is used to produce a polyvinyl alcohol sheet material wherein the polyvinyl alcohol is substantially free of 1,2 diol units, and has an acetal self cross-linked structure

wherein the acetal content is determined by the 1,2 diol content in the sheet material prior to cross-linking. The sheet material product exhibits high conductivity and oxidation resistance, as well as minimal distortion of the prefabricated polyvinyl alcohol sheet material. NASA

24 COMPOSITE MATERIALS

Includes laminates.

N78-22158 Pennsylvania State Univ., University Park.
DYNAMIC MECHANICAL BEHAVIOR OF COMPOSITE MATERIAL UNDER SUSTAINED SINUSOIDAL STRESSES Ph.D. Thesis
Chang-Sun Hong 1977 120 p
Avail: Univ. Microfilms Order No. 7803331

The dynamic properties of multilaminate composites were predicted by using the dynamic properties of a single lamina. Effects of fiber orientations, temperature, the magnitude of static biaxial stress and frequencies of sinusoidal stresses on dynamic properties were studied. Also, a dynamic biaxial testing machine was developed for the measurement of dynamic properties of fiber reinforced materials for a low frequency range. Using the time-temperature equivalence hypothesis, master loss coefficient curves for an extended frequency range were obtained. Secondly, the resonant strength criterion based on the fatigue strength and the loss coefficient of the composite material were developed. Thirdly, with the knowledge of dynamic properties of the composite material, the energy dissipated in the adhesive double lap joint was obtained. Dissert. Abstr.

N78-22159 Purdue Univ., Lafayette, Ind.
THERMAL DIFFUSIVITY OF DISPERSED AND LAYERED COMPOSITES Ph.D. Thesis
Tsu-Yum Richard Lee 1977 138 p
Avail: Univ. Microfilms Order No. 78-03254

Measurements were made of the effective thermal diffusivity at room temperature of two phase composites. The method is based on the flash technique. Data are presented for four types of randomly dispersed composites ranging in particle to matrix diffusivity ratios from 0.48 to 1137; in volume specific heat ratios 0.04 to 1.16 and in volume fraction of dispersed particle from zero up to 34%. The results are compared with those obtained for heterogeneous mixtures, and show that the limitations of the concept of an effective thermal diffusivity are far beyond the situations to which it is currently applied in the transient state heat conduction problems. The validity of certain equations for thermal diffusivity of two phase systems was examined; and the Bruggeman variable dispersion equation was found to agree well with the measured effective diffusivities. Dissert. Abstr.

N78-22160*# IIT Research Inst., Chicago, Ill.
SPACE STABLE THERMAL CONTROL COATINGS Triannual Report, 1 Nov. 1977 - 28 Feb. 1978
Y. Harada Mar. 1978 14 p refs
(Contract NAS8-31906)
(NASA-CR-150671; IITRI-D6118-24(TAR)) Avail: NTIS HC A02/MF A01 CSCL 11D

The studies discussed are designed to yield a Zn2TiO4 paint as an engineering material for use on future spacecraft. Zn2TiO4 pigment powders were synthesized and paint studies were performed. Author

N78-22161*# Lockheed-California Co., Burbank.
FLIGHT SERVICE EVALUATION OF KEVLAR-49 EPOXY COMPOSITE PANELS IN WIDE-BODIED COMMERCIAL TRANSPORT AIRCRAFT Annual Flight Service Report no. 4
R. H. Stone Apr. 1978 65 p refs
(Contract NAS1-11621)
(NASA-CR-145326; AR-4) Avail: NTIS HC A04/MF A01 CSCL 11D

Kevlar-49 fairing panels, installed as flight service components on three L-1011s, were inspected after four years' service, and found to be performing satisfactorily. The Kevlar-49 components were all found to be performing satisfactorily in service with no major problems, or any condition requiring corrective action. The only defects noted were minor impact damage, and a minor degree of fastener hole fraying and elongation. These are for the most part comparable to damage noted on fiberglass fairings. A concurrent investigation was conducted on Kevlar-49/epoxy coupons exposed to an outdoor environment over a three year period at various locations providing a variety of climatic conditions. Weight changes and retention of mechanical properties were determined after one and three years exposure. A net weight loss occurred due to ultraviolet effects on the unpainted specimens. Mechanical property retentions were satisfactory with most specimens retaining well over 80% of their original value. Author

N78-22162*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PARTIAL INTERLAMINAR SEPARATION SYSTEM FOR COMPOSITES Patent Application
Wolf Elber, inventor (to NASA) Filed 24 Mar. 1978 12 p
(NASA-Case-LAR-12065-1; US-Patent-Appl-SN-889671) Avail: NTIS HC A02/MF A01 CSCL 11D

An interlaminar separation system for composites is described where a thin layer of a perforated foil film is interposed between adjacent laminae of a composite formed from prepreg tapes to permit laminae adherence through the perforations and produce a composite structure having improved physical property characteristics. An exemplary composite body was shown formed of a plurality of layers of graphite/epoxy tape with a layer of thin perforated polyester foil disposed between each adjacent two layers of the prepreg tape. When this layup is cured, the prepreg epoxy flows through the perforations in foil layer to effect positive bonding of the prepreg layers. Although the epoxy does not adhere readily to the polyester separator sheets, the bonding occurring through the perforations ensures an adequate lamination for the entire assembly. NASA

N78-22163*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR ALLEVIATING THERMAL STRESS DAMAGE IN LAMINATES Patent Application
C. A. Hoffman, J. W. Weeton, and N. W. Orth, inventors (to NASA) Filed 6 Apr. 1978 16 p
(NASA-Case-LEW-12493-1; US-Patent-Appl-SN-893857) Avail: NTIS HC A02/MF A01 CSCL 11D

According to the method of the invention discontinuities are positively introduced into the interface between layers so as to reduce the thermal stress produced by unequal expansion of the materials which make up the composite. Although a plurality of discrete elements could be used to form one of the layers and thus carry out this purpose, the discontinuities are preferably produced by simply drilling holes in the metallic matrix layer or by forming grooves in a grid pattern in this layer. The apparent novel feature of the invention is the use of geometrical considerations to introduce discontinuities in the matrix of a composite material. This provides for the control of stresses that would otherwise unbound the constituents, cause peeling of the outer layers, and cause the loss of strength properties of the composite when it is subjected to one or more thermal cycles. NASA

N78-22164*# Norton Co., Worcester, Mass.
IMPROVED REACTION SINTERED SILICON NITRIDE Final Report
H. R. Baumgartner Mar. 1978 83 p refs
(Contract NAS3-19723)
(NASA-CR-135291) Avail: NTIS HC A05/MF A01 CSCL 11D

Processing treatments were applied to as-nitrided reaction sintered silicon nitride (RSSN) with the purposes of improving strength after processing to above 350 MN/m2 and improving strength after oxidation exposure. The experimental approaches are divided into three broad classifications: sintering of surface-applied powders; impregnation of solution followed by further thermal processing; and infiltration of molten silicon and subsequent carburization or nitridation of the silicon. The impregnation of RSSN with solutions of aluminum nitrate and zirconyl chloride, followed by heating at 1400-1500 C in a nitrogen atmosphere containing silicon monoxide, improved RSSN

strength and oxidation resistance. The room temperature bend strength of RSSN was increased nearly fifty percent above the untreated strength with mean absolute strengths up to 420 MN/m2. Strengths of treated samples that were measured after a 12 hour oxidation exposure in air were up to 90 percent of the original as-nitrided strength, as compared to retained strengths in the range of 35 to 60 percent for untreated RSSN after the same oxidation exposure. Author

N78-22165# TRW, Inc., Cleveland, Ohio.
FRS COMPOSITES FOR ADVANCED GAS TURBINE ENGINE COMPONENTS Final Report
W. D. Brentnall Aug. 1977 45 p refs
(Contract N62269-76-C-0355)
(AD-A050595; TRW-ER-7887-F; NADC-76077-30) Avail: NTIS HC A03/MF A01 CSCL 11/4

Continued property characterization and fabrication process development of fiber reinforced superalloy (FRS) composites are described. The current investigations included determination of impact toughness, low cycle fatigue properties, and thermal fatigue behavior of angle plied specimens in the W-1ThO2/FeCrAlY system. Additionally, process feasibility studies were performed in the areas of monotape fabrication, secondary bonding and hollow simulated airfoil fabrication. The feasibility of using the Pre-consolidated monotape FRS blade fabrication process was demonstrated. Author (GRA)

N78-22166# Dayton Univ. Research Inst., Ohio.
DEVELOPMENT OF ENGINEERING DATA ON ADVANCED COMPOSITE MATERIALS Final Report, 1 Mar. 1975 - 30 Jun. 1977
D. Robert Askins Sep. 1977 474 p refs
(Contract F33615-75-C-5085)
(AD-A050906; UDRI-TR-77-37; AFML-TR-77-151) Avail: NTIS HC A20/MF A01 CSCL 11/2

Engineering data have been generated on four graphite reinforced advanced composite materials; SP313 (graphite/epoxy by 3M); AS/3004 (graphite/polysulfone by Hercules); AS/4397 (graphite/polyimide by Hercules) and; T300/F178 (graphite/polyimide by Hexcel). Prepreg tape was obtained from each vendor and laminates and test specimens prepared at UDRI. Five different static mechanical properties (tension, compression, flexure, inplane shear, and interlaminar shear) were measured on three fiber orientations (0, 90, and plus or minus 45) at four different temperatures (-67 F, 72 F, and two elevated temperatures). Tensile fatigue, creep, and stress-rupture tests were also conducted and four thermophysical properties (thermal expansion, thermal conductivity, specific heat, and glass transition temperature) were determined. Environmental agings (at 160 F and 100% R.H.) were conducted on each material and the effects of this exposure on several mechanical properties were determined. Author (GRA)

N78-22167# Societe Europeenne de Propulsion, Bordeaux (France).
CARBON-CARBON MATERIALS - CARBON COMPOSITES [MATERIAUX CARBONE-CARBONE COMPOSITES CARBONES]
C. Choury Paris Assoc. Aeron. et Astronautique de France 1977 46 p In FRENCH Presented at the Colloq. on New Mater., Bordeaux, 20-22 Apr. 1977
(AAAF-NT-77-39; ISBN-2-7170-0464-5) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

The application of carbon based materials in solid propellant rocket engine nozzles is discussed. Considered are polycrystalline graphites, pyrographite, carbon reinforced phenolic composites, and carbon-carbon composites. The importance of sepcarb (carbon-carbon) as nozzle material is shown, of which the ablative behavior varies from that of phenolic composites and that of pyrographite, the latter two constituting the extremes of the family of ablative material known at present. ESA

N78-22168# Societe Europeenne de Propulsion, Bordeaux (France).
APPLICATION OF COMPOSITE MATERIALS [MISE EN OEUVRE DES MATERIAUX COMPOSITES]
M. C. Devouge Paris Assoc. Aeron. et Astronautique de France 1977 37 p In FRENCH Presented at the Colloq. on New Mater., Bordeaux, 20-22 Apr. 1977
(AAAF-NT-77-41; ISBN-2-7170-0466-1) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

Rigidimers and carbon-carbon, composite materials produced and used by SEP, are discussed. Rigidimers consist of a carbon, graphite, silicon, and asbestos or glass reinforcements in a phenolic or furan matrix. They are used in nozzles and for thermal internal protection in powder propulsive systems. Carbon-carbon composites (called sepcarb at SEP) consist of a graphite tissue with felt or fiber as reinforcement, the matrix being polycarbon or coke. They are applied at very high temperatures in nozzle inserts, hot expanders, aircraft disk brakes, etc. They are classified as Sepcarb 10, 20, 300, 40, and 500. The production principles of these composite materials are discussed in detail. ESA

N78-22169# Laboratoire de Chimie du Solide du C.N.R.S., Talence (France).
PROSPECTIVES OF BORON FIBER COMPOSITES [PROSPECTIVES SUR LES COMPOSITES A BASE DE FIBRES DE BORE]
R. Naslain Paris Assoc. Aeron. et Astronautique de France 1977 24 p refs In FRENCH Presented at the Colloq. on New Mater., Bordeaux, 20-22 Apr. 1977
(AAAF-NT-77-43; ISBN-2-7170-0468-8) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Possible developments of boron fibers in composite materials are outlined. The development of such materials depends on two factors: the actual costs of boron fiber, high in comparison with other high strength fibers (glass, Kevlar 49, graphite) and the mechanical properties which in certain cases are superior to those of other fibers, notably for boron epoxies. Discussed are possible evolutions of manufacturing conditions of boron fibers; composites based on boron fibers and organic matrices; and boron fiber reinforced metallic matrix composites. ESA

N78-22170# Association Aeronautique et Astronautique de France, Paris.
BORON ALUMINUM COMPOSITE MATERIALS [LES MATERIAUX COMPOSITES BORE-ALUMINIUM]
Jean-Pierre Ferte 1977 28 p refs In FRENCH Presented at the Colloq. on New Mater., Bordeaux, 20-22 Apr. 1977
(AAAF-NT-77-38) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

Boron aluminum composite materials, belonging to the most developed metal matrix composites, are discussed. Manufacturing processes discussed are hot pressing in the semi-liquid phase, hot pressing in the solid phase, quick bonding, and eutectic bonding. The following mechanical properties are dealt with: modulus of elasticity, rupture resistance, and thermal fatigue. The influence of the environment on the properties of boron aluminum composites is also discussed: influence of temperature on longitudinal resistance, extrusion thermal cycles, thermal dilatation, and impact resistance. Applications in the aeronautical and aerospace industry, notably in compressor blades, aircraft structure, and space vehicles, are mentioned. ESA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N78-22171 Vanderbilt Univ., Nashville, Tenn.
SATURATION TRANSFER ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY: THEORETICAL PASSAGE SIGNAL SENSITIVITY OF SLOWLY TUMBLING NITROXIDE RADICALS AND ELECTRON-ELECTRON DOUBLE RESONANCE SPECTRAL DEPENDENCE ON ZEEMAN MODULATION FREQUENCY FOR THE CH2COO- RADICAL Ph.D. Thesis

Ray Clifford Perkins, Jr. 1977 78 p
Avail: Univ. Microfilms Order No. 77-30370

Two types of saturation transfer electron paramagnetic resonance spectroscopy were employed to theoretically investigate two dynamic molecular processes. Passage spectral simulations were performed for nitroxide labeled molecules undergoing isotropic Brownian rotational correlation times between 10 to the -7 power and 10 to the -3 power S and at Zeeman Modulation frequencies of 50 and 100 kHz. The two first harmonic dispersion signals afford both good molecular reorientation sensitivity and the largest signal amplitudes. Dissert. Abstr.

N78-22172 Princeton Univ., N. J.
AN ANALYSIS OF OPTICAL FIBERS FOR PHOTOASSISTED HETEROGENEOUS CATALYSIS Ph.D. Thesis
Richard Eugene Marinangeli 1977 168 p
Avail: Univ. Microfilms Order No. 78-00269

The principles of eternal reflection spectroscopy were applied to describe light transport from an optical fiber to a catalyst coating. A dimensionless group relates light loss from absorption and scattering to light transport in the fiber. An effectiveness factor for light transport was reported as a function of this dimensionless group. Simultaneous mass, heat and light transport in a single, catalyst-coated fiber and in a bundle of such fibers were analyzed. The temperature rise is dominated by energy released by light absorption for typical light intensities and quantum yields. Isothermal or temperature independent reactions have an exponential variation in catalytic activity within the coating due to the light intensity profile. In this case, concentration profiles and effectiveness factors may be obtained in terms of Bessel functions. Finally, the use of semiconductor coated fibers as photoelectrodes was analyzed. Dissert. Abstr.

N78-22173 Utah State Univ., Logan.
A STUDY OF ELECTROCHEMICAL INTERFACIAL PROPERTIES BY MEANS OF ELECTRON SPECTROSCOPY AND ELECTROCHEMICAL METHODS Ph.D. Thesis
Chiu Ling Wang 1977 100 p
Avail: Univ. Microfilms Order No. 7730670

The structure of the electrical double layer of a solid metal-electrolyte solution interphase was studied. A new technique based on the neutrality of charges in the electrical double layer region was developed to determine the number of ions at an electrode. The potential of zero change, carrier density of a thin film conductor and the structures of a surface compound at conductor surfaces were determined. A method was developed to separate faradaic from charging currents by monitoring the electrode current in an electrode immersion-removal process. ESCA (Electron Spectroscopy for Chemical Analysis) spectrometry was used to confirm the presence of certain elements in surface compounds. A method of calibrating an ESCA spectrometer using known surface concentrations of a surface compound was demonstrated with cadmium ions on gold and tin oxide films. Dissert. Abstr.

N78-22174 Illinois Univ., Chicago.
FLUOROMETRIC METHOD FOR TRACE DETERMINATION OF SULFUR DIOXIDE Ph.D. Thesis
Kuo-Chuan Feng 1977 228 p
Avail: Univ. Microfilms Order No. 78-04333

The determination is based on the formation of a fluorescent product, the methanesulfonate derivative of 5-amino-3-sulfosalicylic acid. The fluorometric method uses the same sampling technique as the pararosaniline reference method. The method has a wide working range, from 0.004 mcg/ml to 2.0 mcg/ml sulfur dioxide in the analytical solution. The detection limit is 1 ng/ml SO2 in the analytical solution. The recommended working range is from 0.02 to 0.1 mcg/ml SO2 in the analytical solution. Repetitive determinations of a sample containing 0.067 mcg/ml SO2 in the analytical solution yielded a relative standard deviation of 0.7%. The effects of interferences were minimized by adding sulfanic acid to remove nitrite, by using filtered air free of particulates, and by allowing time for ozone to decay. The fluorometric measurements were performed at 375 nm excitation and 480 nm emission. Dissert. Abstr.

N78-22175 Illinois Univ., Urbana-Champaign.
DEVELOPMENT AND APPLICATION OF A MICROPROCESSOR-CONTROLLED MULTICHANNEL PIPETTING SYSTEM FOR CLINICAL/ANALYTICAL CHEMISTRY Ph.D. Thesis
Richard Parker Gregory, IV 1977 203 p
Avail: Univ. Microfilms Order No. 7804006

A general scheme was developed for the categorization of all pipets and burets. This approach enables the concepts and principles of analytical pipets and burets to be readily recognized. This simplifies evaluation and characterization of these devices including the new multichannel pipet. The multichannel pipet can handle eight solutions simultaneously, aliquoting and delivering micro aliquots into a minidisc in less than 30 seconds with 0.5% reproducibility. The multichannel pipet improves the sample throughout rate and eliminates the errors associated with manual pipetting techniques. Dissert. Abstr.

N78-22176 Illinois Univ., Urbana-Champaign.
A MICROPROCESSOR-CONTROLLED PHOTODIODE ARRAY MEASUREMENT SYSTEM FOR ANALYTICAL SPECTROMETERS Ph.D. Thesis
Daniel Wayne Lovse 1977 497 p
Avail: Univ. Microfilms Order No. 7804077

The array consists of 256 photodiodes linearly spaced one mil apart. Each photodiode has an extended 17 mil high aperture which allows increased sensitivity for spectrometric work. Clock signals necessary to drive the photodiode array were provided from a scan control circuit which was designed to provide the high speed synchronous clock and trigger pulses for the array. The array video output was connected to a high speed integrating charge-to-voltage converter. This voltage was sampled by a high speed analog-to-digital converter. The entire analog-to-digital electronics package, the array clock driving circuitry, and the photodiode array were mounted in a single module that attaches to the front panel of a GCA/McPherson EU-700 monochromator. Dissert. Abstr.

N78-22177 Arizona Univ., Tucson.
THE DEVELOPMENT OF NEW QUADRUPOLAR MASS SPECTROMETRIC TECHNIQUES AND THEIR APPLICATION TO CHEMICAL ANALYSIS Ph.D. Thesis
Ronald Edward Reinsfelder 1977 192 p
Avail: Univ. Microfilms Order No. 7803587

The concept of separator analyzer mass spectrometry was experimentally evaluated. Attention was focused on the use of the quadrupole as a notch filter for the rejection of single mass ions or bands of ions of multiple masses. This mode of operation, which can tolerate ion currents a million times greater than the mass filter, offered a viable approach for the analysis of trace level species diluted in great volumes of host matrix. A discussion of both the format and qualitative theories was given. Dissert. Abstr.

N78-22178 Southern Illinois Univ., Carbondale.
AN ELECTROCHEMICAL INVESTIGATION AND SPECTRAL ANALYSIS OF TRANSITION METAL COMPLEXES OF DIAMINOMALEONITRILE Ph.D. Thesis
Fred Carl Senftleber 1977 266 p
Avail: Univ. Microfilms Order No. 7804311

A cyclic voltammetric and polarographic analysis of Ni (dmn) sub 2 and Pt (dmn) sub 2 in acetronitrile and 1,2 dimethoxyethane and Pd (dmn) sub 2 in tetrahydrofuran showed that each supported a three member electron transfer series consisting of a neutral, mono and dianionic species. With the exception of adsorption, the reduction of the neutral complexes to their respective mono and dianions, on a polarographic time scale, were reversible and uncomplicated by secondary reactions. Through an electron spin resonance study of the monoanionic members of the electron transfer series, the electronic ground state of the central metal and the delocalization of electron spin density into ligand based orbitals in the diaminomaleonitrile complexes were determined. Dissert. Abstr.

N78-22179 Southern Illinois Univ., Carbondale.
DEVELOPMENT OF ELECTROCHEMICAL AND CHROMATOGRAPHIC METHODS FOR DETERMINATION OF SELECTED ORGANIC SULFUR COMPOUNDS Ph.D. Thesis
Andrzej Jerzy Przyjazny 1977 139 p

Avail: Univ. Microfilms Order No. 78-04301

Sensitive electrochemical and chromatographic methods for the determination of trace quantities of sulfones were developed, and their relative merits were compared. Electrochemical methods comprised differential pulse polarography and cathodic stripping voltammetry. The two chromatographic methods developed high pressure liquid chromatography with amperometric and UV detection and gas chromatography with flame photometric detection, were found to be roughly equivalent for the analysis of aromatic sulfones of resolution, time of analysis detection limit, accuracy and precision. In another aspect of the study, methods were developed for the separation and quantitative determination of the following groups of sulfur compounds: thiols, sulfides, disulfides, isothiocyanates, thioamides, and thioureas.

Dissert. Abstr.

N78-22180 Illinois Univ., Urbana-Champaign.

ATOMIC FLUORESCENCE AND ABSORPTION SPECTROMETRY WITH A MICROPROCESSOR-CONTROLLED DYE LASER Ph.D. Thesis

James Arthur Perry 1977 183 p

Avail: Univ. Microfilms Order No. 78-04112

A microprocessor was coupled with a scanning dye laser to yield a stand-alone instrument capable of performing flame atomic fluorescence analysis without external assistance from a minicomputer. Keyboard control allows the experimenter to quickly change such parameters as the number of laser pulses per point or the scan rate. The programs stored in the microprocessor's permanent memory are written in a modular fashion and can be used as basic building blocks when alternative methods of operation are desired. New programs are easily loaded and tested through a small keyboard. The dye laser contains 13 different dye solutions which can be automatically moved into the laser cavity. By adjusting a diffraction grating and selecting the proper dye, the microprocessor can adjust the laser to any wavelength from 360 to 650 nm. The dye laser is optically pumped.

Dissert. Abstr.

N78-22181 Purdue Univ., Lafayette, Ind.

OPTICAL TECHNIQUE FOR PARTICULATE CHARACTERIZATION IN COMBUSTION ENVIRONMENTS: THE MULTIPLE RATIO SINGLE PARTICLE COUNTER Ph.D. Thesis

Edwin Daniel Hirleman, Jr. 1977 194 p

Avail: Univ. Microfilms Order No. 78-03231

A new instrument concept utilizing laser light scattering from individual micron and sub-micron sized particles is reported. To clarify previously neglected effects the first computer simulation of a ratio particle counter system was completed. Included in this simulation are: laser beam properties and the intensity distribution at the sensitive volume near the laser focus, the finite aperture effects and geometry of the scattered light receiving, and data acquisition system characteristics. Results from these studies indicate that the single laser line MRSPC determines spherical particle diameters to within 30% for particles of unknown index of refraction. Utilizing the analysis developed in this study particle concentration distribution can be determined with an accuracy of approximately 60%. Dissert. Abstr.

N78-22182 Pennsylvania State Univ., University Park.

METHODOLOGY FOR DETERMINING COMBUSTION CHARACTERISTICS OF IC ENGINE FUELS Ph.D. Thesis

Thomas William Ryan, III 1977 171 p

Avail: Univ. Microfilms Order No. 78-03363

This study was undertaken to develop the methodology required to determine the combustion characteristics of I.C. engine fuels using a constant volume combustion bomb. A thermodynamic model was used to accurately calculate the total volume of the burned region as a function of time, as well as the thermodynamic properties of ten discrete zones or elements of the mixture. The concentrations of the nitric oxide generated during combustion in the bomb were accurately predicted using the thermodynamic model in conjunction with a chemical kinetics model for nitric oxide formation. The results of a simple unburned hydrocarbon emissions model indicated that it is possible to predict the hydrocarbon emissions using the thermodynamic model and empirical relationships for the quench distance. Dissert. Abstr.

N78-22183 Cornell Univ., Ithaca, N. Y.

DIFFUSION FLAMES IN A CHAMBER FOR LARGE ACTIVATION ENERGY Ph.D. Thesis

Moshe Matalon 1977 123 p

Avail: Univ. Microfilms Order No. 78-06310

The main objective was determination of the response curve; i.e., the unburnt fuel fraction R escaping out the top of the chamber as a function of M, for a given Damkohler number D. The pressure in the chamber was assumed to be constant, and it was characterized by D. Therefore, the solutions described the physical behavior of the system at different pressures. The conclusions were based on activation energy asymptotics, a realistic approach for many combustion problems. Explicit response curves giving R as a function of M were obtained over the whole range of D(O < D < infinity). Two critical values of the Damkohler number, D sub a and D sub o, were distinguished and determined explicitly by the analysis. Accordingly, there were three different ranges of D in which the response curves take various shapes. Dissert. Abstr.

N78-22184*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

COMPATIBILITY STUDIES OF VARIOUS REFRACTORY MATERIALS IN CONTACT WITH MOLTEN SILICON

T. ODonnell, M. Leipold, and M. Hagan 1 Mar. 1978 119 p refs Prepared for DOE

(Contract NAS7-100)

(NASA-CR-156181; JPL-Pub-78-18; DOE/JPL-1012-77/6) Avail: NTIS HC A06/MF A01 CSCL 07D

The production of low cost, efficient solar cells for terrestrial electric power generation involves the manipulation of molten silicon with a present need for noncontaminating, high temperature refractories to be used as containment vessels, ribbon-production dies, and dip-coated substrates. Studies were conducted on the wetting behavior and chemical/physical interactions between molten silicon and various refractory materials. Author

N78-22185*# National Aeronautics and Space Administration, Washington, D. C.

DETERMINATION OF OXYGEN IN SILICON AND CARBIDE BY ACTIVATION WITH 27.2 MeV ALPHA PARTICLES

A. P. Dolgolenko, N. D. Kornienko, and P. G. Lithovchenko Mar. 1978 10 p refs Transl. into ENGLISH from Yadernofizicheskiye Metody Analiza Veshchestva (USSR), 1971 p 184-188 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-2790)

(NASA-TM-75266) Avail: NTIS HC A02/MF A01 CSCL 07D

The Si sample was polished on one side, and on the other side Ni was appiied chemically and soldered with Pb to a water cooled Cu substrate. Optical quartz standard was fixed from the other side. Si carbide samples were soldered to a substrated with In. The prepared samples were irradiated in a cyclotron with a 27.2 MeV alpha particle beam. The layers were removed from the Si and Si carbide samples by grinding and the positron activity of F-18(t sub 1/2 110 min) was measured by using a gamma, gamma coincidence spectrometer with two NaI(Tl) crystals. For analysis of Si carbide, the activity decay curve of the samples was recorded to find the contribution of the positron activity of Cu-65(t sub 1/2 12.9 hr) which formed from Ni impurity on irradiation. Author

N78-22186*# National Aeronautics and Space Administration. Pasadena Office, Calif.

LIQUID REACTANT FEEDER FOR ARC ASSISTED METAL REDUCTION REACTOR Patent Application

Charles B. Wolf (JPL) and Thomas Nolan Meyer, inventors (to NASA) (JPL) Filed 29 Mar. 1978 15 p

(Contract NAS7-100)

(NASA-Case-NPO-14382-1; US-Patent-Appl-SN-891373) Avail: NTIS HC A02/MF A01 CSCL 07C

The liquid reactant feeder assembly of the invention is suitable for injecting and rapidly dispersing liquid reactant into a high temperature gas stream to enhance turbulence and reaction rate. The recessed disposition of the nozzle tip and the special configuration of the entry ports prevent excessive cooling of the interior surfaces by contacting the relatively cool liquid reactant. Thus undesired condensation and buildup of sodium reductant, sodium chloride, or silicon product is avoided. Liquid feeding is superior to gaseous feeding in that more complete and rapid

dispersion of the reagent occur due to the boiling action of the liquid and by the fact that the liquid will penetrate the axial stream rather than be greatly deflected by it. NASA

N78-22187*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A SODIUM STORAGE AND INJECTION SYSTEM Patent Application
Alvin R. Keeton, inventor (to NASA) (Westinghouse Electric Corp., Trafford, Pa.) Filed 24 Feb. 1978 20 p
(Contract NAS7-100)
(NASA-Case-NPO-14384-1; US-Patent-Appl-SN-880728) Avail: NTIS HC A02/MF A01 CSCL 07D

A storage and injection system for liquefied sodium having a capability of functioning in a start-up, shut-down, normal operating and emergency mode is described. The system is embodied in a sodium storage and injection system. Atomized liquid sodium was delivered to a chemical reactor employed in the production of solar grade silicon. The system is characterized by a jacketed injection nozzle, adapted to utilize inert gas for atomizing liquefied sodium, connected to a supply circuit for delivering liquefied sodium. The circuit comprises a plurality of interconnectable, individually replaceable, sodium containment vessels, a pump interposed between the vessels and the nozzle, and a pressurizing circuit including a source of inert gas connected with the vessel for maintaining the sodium under pressure. By employing the system it is possible to deliver and inject a fine spray of high purity sodium into a chemical reactor. NASA

N78-22188*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ADSORPTION AND CHEMICAL REACTION OF GASEOUS MIXTURES OF HYDROGEN CHLORIDE AND WATER ON ALUMINUM OXIDE AND APPLICATION TO SOLID-PROPELLANT ROCKET EXHAUST CLOUDS
W. R. Cofer, III and G. L. Pellett Apr. 1978 39 p refs
(NASA-TP-1105; L-11800) Avail: NTIS HC A03/MF A01 CSCL 07D

Hydrogen chloride (HCl) and aluminum oxide (Al_2O_3) are major exhaust products of solid rocket motors (SRM). Samples of calcination-produced alumina were exposed to continuously flowing mixtures of gaseous HCl/H_2O in nitrogen. Transient sorption rates, as well as maximum sorptive capacities, were found to be largely controlled by specific surface area for samples of alpha, theta, and gamma alumina. Sorption rates for small samples were characterized linearly with an empirical relationship that accounted for specific area and logarithmic time. Chemisorption occurred on all aluminas studied and appeared to form from the sorption of about a 2/5 HCl-to-H_2O mole ratio. The chemisorbed phase was predominantly water soluble, yielding chloride/aluminum III ion mole ratios of about 3.3/1 suggestive of dissolved surface chlorides and/or oxychlorides. Isopiestic experiments in hydrochloric acid indicated that dissolution of alumina led to an increase in water-vapor pressure. Dissolution in aqueous SRM acid aerosol droplets, therefore, might be expected to promote evaporation. Author

N78-22189# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
THEORIES OF ENERGY DISPOSAL IN CHEMICAL REACTIONS Final Report, 1 Jun. 1973 - 30 Jun. 1977
Aron Kupperman Feb. 1978 191 p refs
(Grant AF-AFOSR-2539-73)
(AD-A050968; AFOSR-78-0247TR) Avail: NTIS HC A09/MF A01 CSCL 09/2

Accurate and approximate quantum dynamical calculations on elementary chemical reactions of importance for the fundamental aspects of chemical dynamics and for advanced technologies of interest to the US Air Force, such as high energy chemical lasers, plume technology, and the chemical effects of high energy radiation, were performed. These included calculations of three-atom exchange reactions, breakup collisions, three-body recombinations, vibrational quenching by reaction, resonances, and electronic branching ratios. The aim of these calculations was to develop an understanding of these processes and to develop benchmark data against which approximate methods could be tested. Author (GRA)

N78-22190# Chicago Univ., Ill. Dept. of Chemistry.
CHEMISTRY AT ELECTRODE SURFACES Final Report, Nov. 1974 - 31 Oct. 1977
Stephen Mazur 29 Dec. 1977 4 p
(Grant DAHC04-75-G-0064)
(AD-A050680; ARO-12711.6-C) Avail: NTIS HC A02/MF A01 CSCL 10/3

The objective has been to elucidate the structure of functional groups at the prismatic surfaces of graphite and related forms of carbon. The objective is to make use of this functionality in order to manipulate the chemistry at the surface of carbon electrodes. Central to this project has been the proposition that prismatic surfaces of graphite, when freed of the usual surface oxides, should be composed of functionality resembling certain dehydroaromatic molecules. It would then follow that the reactivity of these surfaces should be analogous to the reactivity of the dehydroaromatics. Author (GRA)

N78-22191# Battelle Columbus Labs., Ohio.
COMPUTATIONAL STUDY OF CHEMICAL REACTION DYNAMICS AT THE GAS-SOLID INTERFACE Final Report
G. Wolken 10 Nov. 1977 51 p refs
(Contract F49620-77-C-0004)
(AD-A050893; AFOSR-78-0256TR) Avail: NTIS HC A04/MF A01 CSCL 07/4

Using computer simulations an investigation was carried out describing the conditions under which a heterogeneously catalyzed reaction will enhance the deposit of energy into laser-active modes. The model describes the internal vibration-rotation states of diatomic molecules as they are formed and adsorbed from the surface. In addition an attempt is made to understand the particular features in the potential which lead to particular internal states. Author (GRA)

N78-22192# Alabama Univ., University. Dept. of Chemistry.
CATALYTIC REACTIONS PROMOTED BY HOMOGENEOUS CATALYSTS ATTACHED TO POLYSTYRENE MATRICES Interim Report
Charles U. Pittman, Jr., Quock Ng, Akira Hirao, William Honnick, and Ronnie Hanes 24 Feb. 1978 66 p refs
(Contract N00014-75-C-0689)
(AD-A050766; TR-20) Avail: NTIS HC A04/MF A01 CSCL 07/3

Styrene-divinylbenzene resins have been functionalized with phosphine ligands and these phosphinated resins have been used to immobilize Rh(I), Ir(I), and Pd(O) catalysts. The selectivity of Rh(I)-catalyzed hydroformylations and the optical yields in styrene hydroformylations have been examined as a function of ligand loading and P/Rh ratios. The rates of Ir(I)-catalyzed hydrogenations of 1,5-cyclooctadienes and Pd(O)-catalyzed butadiene dimerization-methoxylations were studied. In all cases the resin-catalyzed reactions were compared to their homogeneously catalyzed analogs. All the results appear to be explained in terms of the influence of the resin matrix on metal-ligand equilibria which play important roles in the reaction mechanisms. Author (GRA)

N78-22193# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
INTERACTION OF OXYGEN WITH CARBONACEOUS LAYERS ON Ni (110) I: DEHYDROGENATED ETHYLENE LAYERS AT TEMPERATURES LESS THAN 300 C
Radhesyam Sau and John B. Hudson 1 Dec. 1977 25 p refs
(Contract N00014-75-C-0730)
(AD-A050541; TR-5) Avail: NTIS HC A02/MF A01 CSCL 11/6

Previous studies of ethylene adsorption and decomposition on a Ni(110) single crystal surface have been extended to measurement of the interaction of oxygen molecular beams with the carbonaceous layers formed in the ethylene adsorption process. A combination of Auger electron spectrometric and modulated molecular beam techniques have been used to measure the kinetics of oxygen adsorption and CO production on the surface. Results for oxygen adsorption on the clean Ni(110) surface are in agreement with previous studies. For the surface formed by adsorbing ethylene on the clean nickel surface at room temperature, adsorption of oxygen results in formation of a surface layer of NiO without removal of carbon from the surface. Exposure of

the ethyleneated nickel surface to oxygen at 260 C results in the removal of a fraction of the carbon, as CO, followed by NiO formation. Author (GRA)

N78-22194# Ames Lab., Iowa.
EVALUATION OF SELF-INTERACTION PARAMETERS FROM BINARY PHASE DIAGRAMS M.S. Thesis
Thomas Lee Ellison Oct. 1977 91 p refs
(Contract W-7405-eng-82)
(IS-T-772) Avail: NTIS HC A05/MF A01

The feasibility of calculating Wagner self interaction parameters from binary phase diagrams was examined. The self interaction parameters of 22 nonferrous liquid solutions were calculated utilizing an equation based on the equality of the chemical potentials of a component in two equilibrium phases. Utilization of the equation required the evaluation of the first and second derivatives of various liquids and solidus data at infinite dilution of the solute component. Several numerical methods for evaluating the derivatives of tabular data were examined. A method involving power series curve fitting and subsequent differentiation of the power series was found to be the most suitable for the interaction parameter calculations. ERA

N78-22195# Addis Translations International, Portola Valley, Calif.
BEHAVIOR OF NOBLE GASES IN SOLIDS: HELIUM IN TITANIUM HYDRIDE M.S. Thesis - Tel Aviv Univ., Israel
Lipshitz Yeshayahu Oct. 1977 169 p refs Transl. into ENGLISH of Report IA-1330 from Israel Atomic Energy Commission, Tel Aviv, Sep. 1976 Sponsored by ERDA Prepared for Sandia Labs., Albuquerque, N. Mex.
(SAND-77-6020; IA-1330) Avail: NTIS HC A08/MF A01

The behavior of noble gases in solids was investigated. The specimen selected was titanium tritide, in which helium is generated by the radioactive decay of tritium. The method was to measure the helium release rate from the specimen and to determine the dependence of this release rate on various parameters. ERA

N78-22196# Association Aeronautique et Astronautique de France, Paris.
THE CARBONS. THE DIFFERENT CLASSES OF CARBON, PREPARATION, PROPERTIES, UTILIZATION [LES CARBONES. LES DIFFERENTES CLASSES DE CARBONES, PREPARATION, PROPRIETES, UTILISATION]
1977 9 p In FRENCH
(AAAF-NT-77-33; ISBN-2-7170-0458-0) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Starting from any material, solid, liquid or gaseous, containing among other elements, carbon, one can prepare a variety of products containing practically only carbon. These products are called carbons and can be subdivided into classes: diamond, graphite, pyrocarbons, carbon blacks, carbon fibers, having distinct textures, structures, and physical and chemical properties which are discussed briefly. ESA

N78-22573# Israeli Program for Scientific Translations Ltd., Jerusalem.
SOLAR ACTIVITY AND CHEMICAL TESTS
Giorgio Piccardi *In its* effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 155-163 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

N78-23036# European Space Agency, Paris (France).
LIQUID ALLOY ANALYZER IN VACUUM BY X EMISSION SPECTROGRAPHY
Bernard Daigne and Francois Girard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 41-52 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 231-237 Original report in FRENCH previously announced as A77-50439 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-22197 State Univ. of New York, Buffalo.
PORE SIZE DISTRIBUTION AND CATALYTIC ACTIVITY IN ISOPROPANOL DEHYDRATION OF POROUS ANODIC ALUMINA FILMS Ph.D. Thesis
Son-Ki Ihm 1977 143 p
Avail: Univ. Microfilms Order No. 77-32668

Alumina films prepared by anodic oxidation of aluminum foils in oxalic acid contain parallel cylindrical pores closed at one end. The average pore diameters are in the range of macropores (68 to 128nm for the applied voltages of 25 to 50 V), and the pore density is of the order of 10 billion pores per square centimeters. Nitrogen isotherms are measured on these films and the pore size distributions computed by using Kelvin, Cohan, and Broekhoff-de Boer equations. Anodic alumina sheets calcined at 620 C were used to study the kinetics of dehydration of isopropyl alcohol. Direct information concerning the reaction rate and the mass transfer coefficient was obtained. For the reaction considered, the catalytic activation energy using the anodic alumina catalyst is found to be smaller than that using other aluminas. Dissert. Abstr.

N78-22198 Utah State Univ., Logan.
THE OXIDATION OF SILVER THIN FILMS BY ATOMIC OXYGEN Ph.D. Thesis
Peter Joseph Codella 1977 187 p
Avail: Univ. Microfilms Order No. 7730641

The reduction of the oxidized films by atomic nitrogen and thermal decompositions were observed. The mass gained by silver thin films during atomic oxygen oxidation was monitored with a quartz crystal microbalance. The atomic oxygen was generated by the nitric oxide titration of atomic nitrogen produced in a microwave discharge. The oxygen released during thermal decompositions of oxidized films was monitored with a quadrupole mass spectrometer. The mass gain versus time plots indicate three distanct oxidation rates. The break between the first and second comes at or slightly above the stoichiometric mass gain to AgO. The initial rate is identified as the rate of oxidation of silver to AgO, and exhibits first order kinetics with respect to the atomic oxygen concentration. A method is shown to be feasible for the detection of atomic oxygen. This is a surface reflection technique which monitors the darkening of a silver surface by atomic oxygen as the oxide is formed. Dissert. Abstr.

N78-22199 Wisconsin Univ., Madison.
A STUDY OF DILUTE ALUMINUM-GOLD ALLOYS FOR SUPERCONDUCTOR STABILIZER APPLICATIONS Ph.D. Thesis
Karl Theodore Hartwig, Jr. 1977 324 p
Avail: Univ. Microfilms Order No. 77-25824

Dilute Al-Au alloys for superconductor stabilizer applications were assessed. Increased strength coupled with low electrical resistivity at cryogenic temperatures was considered to be of primary importance in the development of an acceptable stabilizer alloy. Control over a wide variation in mechanical and physical characteristics was achieved by subjecting Al-Au alloys to precipitation hardening treatments. Annealing phenomena were monitored by resistivity measurements at 273, 77, and 4.2 K and by yield strength measurements at 296, 77, and 4.2 K. Transmission electron microscopy was employed to confirm the presence of an intermetallic precipitate dispersion in aged Al-Au. Dissert. Abstr.

N78-22200 Illinois Univ., Urbana-Champaign.
STRESS CORROSION CRACKING OF ADMIRALTY METAL IN AQUEOUS AMMONIA Ph.D. Thesis
John Alvin Beavers 1977 164 p
Avail: Univ. Microfilms Order No. 78-03932

The propagation of transgranular stress corrosion cracks was investigated in commercial grade admiralty metal tested in three ammoniacal solutions. Fractographic studies indicated that cracking occurs on parallel but displaced 110 facets and that the steps between the fracture facets are also crystallographic

in nature, consisting of alternating segments of two 111 planes. The overall direction of the steps was observed to be perpendicular to the crack front. Examination of opposing surfaces indicated that the surface features are matching and interlocking. It is concluded that cracking occurs by cleavage on 110 planes and that fracture steps are formed by shear on 111 planes. Cracking velocities were measured. Evidence of crack arrest markings was found on the fracture surfaces and crack propagation was found to be associated with discrete acoustic emission events. It is concluded that crack propagation occurs by discontinuous cleavage. Dissert. Abstr.

N78-22201 Case Western Reserve Univ., Cleveland, Ohio.
FRACTURE TOUGHNESS OF ALUMINUM DIE CASTING DIE STEELS Ph.D. Thesis
Richard Bernard Bertolo 1976 231 p
Avail: Univ. Microfilms Order No. 78-03905

Tensile, toughness and thermal fatigue properties were determined on H13 and 300 maraging steel, two die materials which are used in the aluminum die casting industry. The influence of several factors on these mechanical properties was evaluated including the austenitization temperature and hardness level of the H13 material and the aging temperature of the 300 maraging alloy. The toughness values from three tests were compared: plane strain fracture toughness (K sub Ic), conventional Charpy V-notch impact toughness, and instrumented precracked Charpy impact toughness. Dissert. Abstr.

N78-22202 American Univ., Washington, D. C.
INVESTIGATION OF THE ANODIC DISSOLUTION OF METALS BY CYCLIC VOLTAMMETRY Ph.D. Thesis
Richard Dennis Granata 1977 210 p
Avail: Univ. Microfilms Order No. 78-00646

The electrochemical technique of cyclic voltammetry was evaluated for its utility in the investigation of anodic dissolution processes. The specific systems studied were: (1) Aluminum alloy 7075 in sulfuric acid with chloride and bromide. (2) Iron in pH 3.0 sulfate solutions with additions of chloride, ferricyanide, and o-phenanthroline. (3) Metals and alloys in the proposed fuel cell electrolyte, trifluoromethanesulfonic acid monohydrate. The technique of cyclic voltammetry consists of monitoring the current response of an electrode system subjected to a cyclic (periodic) linear variation of potential. In addition, the effect of scan rate (rate of linear variation of potential) can provide additional information on electrode processes. Dissert. Abstr.

N78-22203 Engineering Sciences Data Unit, London (England).
FATIGUE OF WROUGHT AND CAST ANNEALED Ti-5Al-2.5Sn TITANIUM ALLOY (IN BENDING AND UNDER AXIAL LOADING)
Dec. 1977 8 p
(ESDU-77033; ISBN-0-85679-206-3) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $146.50

Fatigue data were provided for forged (1) bar specimens axially loaded and in bending, (2) sheet specimens in bending and (3) cast specimens loaded axially. The curves are presented in terms of (K sub t)(S sub a)/(f sub t), so that comparisons of the fatigue strength of plain and notched specimens can be made. The effect of variations in the value of mean stress, represented by the ratio (S' sub m)/(f sub t), were available only for the cast material data. Author

N78-22204*# Grumman Aerospace Corp., Bethpage, N.Y.
DESIGN AND FABRICATION OF METALLIC THERMAL PROTECTION SYSTEMS FOR AEROSPACE VEHICLES
Angelo Varisco, Paul Bell, and Willy Wolter Feb. 1978 188 p refs
(Contract NAS1-14112)
(NASA-CR-145313) Avail: NTIS HC A09/MF A01 CSCL 11F

A program was conducted to develop a lightweight, efficient metallic thermal protection system (TPS) for application to future shuttle-type reentry vehicles, advanced space transports, and hypersonic cruise vehicles. Technical requirements were generally derived from the space shuttle. A corrugation-stiffened beaded-skin TPS design was used as a baseline. The system was updated and modified to incorporate the latest technology developments and design criteria. The primary objective was to minimize mass for the total system. Author

N78-22205*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TOUGHNESS-HIGH STRENGTH IRON ALLOY Patent Application
J. R. Stephens and W. R. Witkke, inventors (to NASA) Filed 13 Dec. 1977 12 p
(NASA-Case-LEW-12542-2; US-Patent-Appl-SN-860405) Avail: NTIS HC A02/MF A01 CSCL 11F

A steel alloy is provided which exhibits excellent strength and toughness characteristics at cryogenic temperatures. The alloy consists essentially of about 10 to 16 percent by weight nickel, about 0.1 to 1.0 percent by weight aluminum, and 0 to about 3 percent by weight of at least one of the following additional elements: copper, lanthanum, niobium, tantalum, titanium, vanadium, yttrium, zirconium, and the rare earth metals, with the balance being essentially iron. The steel alloy is produced by a process which includes using cold rolling at room temperature and subsequent heat treatment at temperatures ranging from 500 to 650 C, and possesses a fracture toughness ranging from 200 to 230 ksi square root of (in.) and yield strengths up to 230 ksi. NASA

N78-22206# Royal Aircraft Establishment, Farnborough (England).
EXPERIMENTAL EVIDENCE OF TWO STRESS CORROSION MECHANISMS IN AN Al-Zn-Mg-Cu ALLOY
C. Renon and H. Martinod Sep. 1977 29 p refs Transl. into ENGLISH from La Recherche Aerospatiale (France), no. 3, 1977 p 179-190
(RAE-Trans-Lib-1943; BR61906) Avail: NTIS HC A03/MF A01

The assistance to stress corrosion, in a chloride solution, of a thick sheet of AZ5GU (7075) in the short transverse direction was coupled with the micrographic aspects of the very first stages of cracking. Observations showed that there were two possible processes for crack initiation, one of purely electrochemical character, the other with a main mechanical component. The predominance of one or other of these initiation mechanisms was only a function of the thermal treatment carried out on the alloy and of the resulting structural precipitation; it does not depend on the corrosion conditions; these however have a strong influence on the growth rate of the preferred cracking type in a given state of the alloy. Author

N78-22207# Royal Aircraft Establishment, Farnborough (England).
STRESS-CORROSION OF THICK ALUMINUM PLATES. METHOD OF TEST BY FRENCH INDUSTRIAL LABORATORIES
M. Reboul, J.-P. Pouget, and S. Pinochet Oct. 1977 27 p refs Transl. into ENGLISH from Metaux (Corros.-Ind.) (France), v. 615, 1976 p 375-387
(RAE-Trans-Lib-1954; BR61907) Avail: NTIS HC A03/MF A01

The necessity for a standard method of testing stress corrosion behavior in French laboratories is discussed. Differences between laboratories are based on three parameters: (1) surface preparation of specimens; (2) the method of applying stress; and (3) the composition of the corrosive solution. Methods used in France were compared with those used in the United States in an effort to choose the best conditions among those already in use. Author

N78-22208# Army Materials and Mechanics Research Center, Watertown, Mass. Metals Research Div.
MECHANICAL PROPERTY AND MICROSTRUCTURAL EVALUATION OF MARAGING STEELS Final Report
Charles F. Hickey, Jr. Jan. 1978 11 p refs
(AD-A050840; AMMRC-MS-78-1) Avail: NTIS HC A02/MF A01 CSCL 19/1

This report contains the results of a material characterization study which was conducted on various grades of 18 percent nickel maraging steel which have been considered for use as the sheath material for the kinetic energy M-735 penetrator.

Investigated grades include the 200, 250, 300, and 350. Data presented and discussed are hardness, tensile properties, hoop strength, Charpy impact, and fracture toughness (KQ, W/A, and KId). Additional areas addressed include material processing, chemistry, cleanliness, and heat treatment. Results of the study indicate that the materials generally meet the requirements put forth in MIL-S-46850A, the military specification under which they were procured. The 350 grade is not included in this specification. Author (GRA)

N78-22209# California Univ., Los Angeles. Dept. of Chemistry.

STRUCTURES OF METALLOCARBORANES. 9: CRYSTAL AND MOLECULAR STRUCTURE OF THE TEN-VERTEX HETEROBIMETALLOCARBORANE 2,3-DI-ETA-CYCLOPENADIENYL-10-CARBA-(2,3-(NICKELACOBALTA)-DECABORANE(8), 2,3-(N-C5H5)2-(2,3) NiCo-10-CB7H8

G. E. Hardy, K. P. Callahan, and M. F. Hawthorne 18 Jan. 1978 32 p refs Submitted for Publication

(Contract N00014-76-C-0390)

(AD-A050502; TR-100; Contrib-3915) Avail: NTIS HC A03/MF A01 CSCL 07/2

Polyhedral expansion of the monocarbacobaltacarborane anion C5H5(-)Co-CB7H8(-) with NiBr2-2 glyme in the presence of C5H5(-) affords several neutral isomeric complexes of the formula (C5H5)2NiCoCB7H8 which contain formal NiIV) and Co(III) vertices, and which are isoelectronic with (C5H5) 2Co2C2B6H8. The structure of one isomer of the latter has previously been reported; the mixed cobalt-nickel compounds exist in more numerous isomeric forms. An X-ray structural investigation of one isomer of this complex is reported herein. GRA

N78-22210# Naval Weapons Center, China Lake, Calif.

VARIATIONS IN OPTICAL REFLECTIVITY OF SPUTTER DEPOSITED METAL AND SEMIMETAL FILMS Summary Report, 1975

H. F. Blazek, G. H. Turner, and C. W. Cutsinger Dec. 1977 26 p refs

(AD-A050681; NWC-TP-5997) Avail: NTIS HC A03/MF A01 CSCL 20/5

The surface structure of vacuum sputter deposited metal and semimetal films can be varied by changing the substrate bias potential and the total time of deposition. The corresponding change in the optical reflectivity can be related to enhanced scattering and absorption effects. Reflectivity measurements over the infrared ranging from 1 to 7 microns are presented and discussed for titanium, antimony, bismuth, and copper films. Results for the metal films, copper and titanium, are in agreement with those obtained by Bennett for aluminum films. The results for antimony and bismuth indicate the influence of enhanced absorption. Author (GRA)

N78-22211# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

MACHINE CASTING OF HIGH TEMPERATURE ALLOYS FOR TURBINE ENGINE COMPONENTS Final Report, 1 Mar. 1976 - 30 Apr. 1977

L. F. Schulmeister, J. D. Hostetler, and C. C. Law Sep. 1977 91 p refs

(Contract DAAG46-76-C-0029; ARPA Order 2267)

(AD-A050698; FR-8984; AMMRC-CTR-77-21) Avail: NTIS HC A05/MF A01 CSCL 13/8

A program has been initiated to evaluate the capability of machine casting for fabricating components for gas turbine engines such as compressor airfoils. The goal is to evaluate the capability of the process to produce an end product of high quality on an economic basis. During this contract, machine casting activity consisted of equipment modification to an existing machine casting unit which included mechanization of the process. Concurrently, statistical assessment of process parameter effects using Rheocast Haynes Alloy 31 (cobalt-base alloy) as a vehicle was performed. Machine casting preforms containing varying volume fractions of solid were inspected at different die temperatures and injection speeds and were evaluated both non-destructively and metallographically. Results indicated that quality of high volume fraction parts was improved using high injection speeds and low die temperatures. An alternate die design was also evaluated. Heat treatment response studies were also performed on machine cast specimens. Results indicated that long term anneals followed by aging yielded microstructures similar to cast and heat treated Haynes 31. Mechanical property evaluation consisted of room temperature, 1000 F and 1450 F tensile testing, 1450 F stress rupture and room temperature high cycle fatigue (HCF) testing. Tensile data indicated that tensile design goals could be achieved. Stress rupture and HCF goals were achieved through the use of hot isostatic capacitation to reduce internal porosity in the machine cast specimens. GRA

N78-22212# Illinois Univ., Urbana-Champaign. Dept. of Mechanical and Industrial Engineering.

MACHINE CASTING OF FERROUS ALLOYS

R. Mehrabian, D. G. Backman, G. J. Abbaschian, Y. V. Murty, and S. D. E. Ramati Oct. 1977 54 p refs

(Contract DAAG46-76-C-0023)

(AD-A050701; AMMRC-CTR-77-26; SAR-3) Avail: NTIS HC A04/MF A01 CSCL 11/6

Emphasis of the work at the University of Illinois is on processes and casting systems which employ a partially solid alloy as charge material. The program at the University of Illinois is especially designed to establish the processing conditions necessary to produce porosity-free parts and to evaluate the rheocasting and thixocasting processes from both a technical and an economical point of view. Author (GRA)

N78-22213# Naval Ordnance Station, Louisville, Ky.

METAL MATRIX COMPOSITES, GRAPHITE-ALUMINUM WIRE, PHASE 1 Final Report

Howard R. Paul Apr. 1977 105 p refs

(AD-A050600; NOSL-MT-044) Avail: NTIS HC A06/MF A01 CSCL 11/2

The objectives of the program were to: (1) develop a production process to produce rayon precursor graphite-aluminum wire with a capacity of 1000 lbs. per year in accordance with Naval Sea Systems Command development specification for metal-matrix composites MTP-114, dated 13 January 1975, (2) optimize the process for the design of a single unit that would produce 2000 lbs. of polyacrylonitrile (PAN) graphite-aluminum wire per year, and (3) demonstrate the 1000 lb. per year production process by producing 100 lbs. of graphite-aluminum wire. GRA

N78-22214# SRI International Corp., Menlo Park, Calif.

THERMOCHEMISTRY OF GASEOUS COMPOUNDS OF METALS Final Report, 5 Dec. 1972 - 4 Dec. 1977

D. L. Hildenbrand, P. D. Kleinschmidt, and K. H. Lau Jan. 1978 19 p refs

(Contract F44620-73-C-0037)

(AD-A050602; AFOSR-78-0163TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The results obtained during a five-year program of thermochemical studies of gaseous inorganic metal compounds are summarized in this report. Thermochemical data were derived from equilibrium measurements made by high-temperature mass spectrometry and related effusion techniques, and from electron impact threshold measurements. Derived thermochemical properties included standard heats of formation, bond dissociation energies, ionization potentials, and, in some cases, electron affinities. Author (GRA)

N78-22215# Princeton Univ., N. J. Dept. of Chemistry.

REACTION SCHEMES FOR DINUCLEAR COMPOUNDS CONTAINING METAL-TO-METAL TRIPLE BONDS ILLUSTRATED BY RECENT FINDINGS IN THE CHEMISTRY OF MOLYBDENUM AND TUNGSTEN

Malcolm H. Chisholm 14 Feb. 1978 27 p refs

(Contract N00014-76-C-0826)

(AD-A050776; TR-78-08) Avail: NTIS HC A03/MF A01 CSCL 07/3

A number of general modes of reaction are proposed for compounds containing homonuclear metal-to-metal triple bonds. These are discussed in the light of recent experimental observations. Author (GRA)

N78-22216# Naval Postgraduate School, Monterey, Calif. Materials Science and Chemistry Group.

EFFECTS OF DISSIMILAR METAL COUPLING, POTENTIAL

DISTRIBUTION, AND TEMPER CONDITION GALVANIC CORROSION OF 5086 ALUMINUM ALLOY IN SYNTHETIC SEAWATER Interim Report, Mar. - Dec. 1977

Jeff Perkins, John S. Locke, and Kenneth J. Graham Jan. 1978 65 p refs

(AD-A050917; NPS-69PS-78-001; NPS-TR-5) Avail: NTIS HC A04/MF A01 CSCL 11/6

The galvanic corrosion behavior of 5086 aluminum alloy in three tempers (H116, H117, H32) when coupled with more noble metals (1040 steel, naval brass, and Ti-150A titanium) and immersed in aerated synthetic seawater, was studied. Galvanic current density measurements, potentiodynamic polarization determinations, and optical and electron microscopic observations were made. GRA

N78-22217# IBM Watson Research Center, Yorktown Heights, N.Y.

SURFACE OPTICAL EXCITATIONS ASSOCIATED WITH CO CHEMISORPTION ON Ni(III)

G. W. Rubloff and J. L. Freeouf 15 Jan. 1978 34 p refs Submitted for publication

(Contract N00014-77-C-0366; Grant NSF DMR-74-15089)

(AD-A050549; TR-3) Avail: NTIS HC A03/MF A01 CSCL 11/6

Surface optical excitations associated with CO chemisorption on Ni (111) have been studied using surface reflectance spectroscopy (SRS) and electron energy loss spectroscopy (ELS). SRS measurements using s- and p-polarized light in the photon energy range 4-35 eV are analyzed using a simple dielectric model to deduce surface optical transitions. A comparison of the SRS and ELS results for CO/Ni (111) with the optical excitations in gas and solid phase CO and in transition metal carbonyls reveals correlations in spectral structure which are used as a basis to suggest possible identifications of the surface optical transitions. GRA

N78-22218# Rensselaer Polytechnic Inst., Troy, N. Y.

EFFECTS OF HYDROGEN ON FATIGUE OF VANADIUM AND NIOBIUM Annual Report

Norman S. Stoloff and D. W. Chung 15 Jan. 1977 47 p refs

(Contract EY-76-S-02-3459)

(COO-3459-12) Avail: NTIS HC A03/MF A01

The fatigue behavior of unalloyed vanadium and niobium as well as their alloys with hydrogen is described. The response of vanadium-hydrogen alloys to cyclic loading was shown to depend markedly upon the presence or absence of notches, the hydrogen level, method of test, and frequency. In general, hydrides improve high cycle life of unnotched alloys, but are detrimental in the presence of a notch. Low test frequencies also lead to reduced fatigue lives. Unalloyed vanadium and solid solution vanadium hydrogen alloys do not undergo delayed failure. Preliminary tests on unalloyed niobium and several niobium vanadium alloys reveal improvements in stress controlled fatigue life and decreased low cycle life. ERA

N78-22219# Oak Ridge Gaseous Diffusion Plant, Tenn. Special Services Dept.

ELECTROPOTENTIAL MEASUREMENTS OF PASSIVATION AND CORROSION OF STEEL COUPONS

G. S. Petit and R. R. Wright Feb. 1977 19 p ref

(Contract W-7405-eng-26)

(K-1890) Avail: NTIS HC A02/MF A01

There is considerable interest in the preparation of mild steel to resist corrosion (passivation) both in moist air and uranium hexafluoride (UF6) environments. Steel prepared by the usual procedures to prevent rusting, such as oiling, plastic coating, painting, or phosphating, cannot be used in the presence of UF6. Tests showed that a chromate treatment or an ammoniacal citrate treatment for passivation are effective. The electropotential behavior of these two passivation treatments is described. The initial electropotential measurement, when compared to that of an unpassivated coupon, gives the electropotential degree in volts of passivation. Continual exposure in the test, when compared to the unpassivated coupon, gives a profile of the durability of the passivation film. The chromate passivation treatment was slightly superior to the citrate passivation. ERA

N78-22220# Hanford Engineering Development Lab., Richland, Wash.

EFFECT OF TEMPERATURE ON THE ELASTIC-PLASTIC FRACTURE TOUGHNESS BEHAVIOR OF INCONEL X-750

W. J. Mills Sep. 1977 30 p refs

(Contract EY-76-C-14-2170)

(HEDL-TME-77-65) Avail: NTIS HC A03/MF A01

The elastic-plastic J/sub Ic/ fracture toughness response of precipitation heat treated Inconel X-750 was evaluated by the multi-specimen resistance curve technique at room temperature, 427 C, and 538 C. The value of J/sub Ic/ for this nickel-base superalloy was found to be relatively independent of temperature over the test temperature range. The slopes of the fracture toughness R-curves were steeper at 4 27 and 538 C than at 24 C, thereby indicating that the resistance to crack extension was considerably greater at elevated temperatures. Metallographic and electron fractographic examination of the fracture surfaces revealed that this slope change phenomenon was associated with an intergranular to transgranular fracture mechanism transition. Under room temperature conditions, crack extension occurred primarily by an intergranular dimple rupture mechanism attributed to microvoid coalescence along a grain boundary denuded region. In the 427 to 538 C regime, the fracture surface was dominated by a faceted transgranular morphology. ERA

N78-22221*# Sandia Labs., Albuquerque, N. Mex.

HIGH-TEMPERATURE DUCTILITY OF ELECTRO-DEPOSITED NICKEL Progress Report, period ending 31 May 1977

J. W. Dini and H. R. Johnson Jul. 1977 36 p refs Sponsored in part by NASA

(Contract EY-76-C-04-0789)

(NASA-CR-156922; SAND-77-8020) Avail: NTIS HC A03/MF A01 CSCL 11F

Work done during the past several months on high temperature ductility of electrodeposited nickel is summarized. Data are presented which show that earlier measurements made at NASA-Langley erred on the low side, that strain rate has a marked influence on high temperature ductility, and that codeposition of a small amount of manganese helps to improve high temperature ductility. Influences of a number of other factors on nickel properties were also investigated. They included plating solution temperature, current density, agitation, and elimination of the wetting agent from the plating solution. Repair of a large nozzle section by nickel plating is described. ERA

N78-22222# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

TEMPERATURE DEPENDENCE OF NITRATE STRESS CORROSION CRACKING OF MILD STEEL

J. A. Donovan 1977 12 p refs Presented at the AIME Symp. on Environ.-Sensitive Fracture of Eng. Alloys, Chicago, 24-27 Oct. 1977

(Contract EY-76-C-09-0001)

(DP-MS-77-25; Conf-771066-1) Avail: NTIS HC A02/MF A01

The temperature dependence of nitrate stress corrosion in mild steel is given by activation energies of 27 kJ/mol for continuous and 56 kJ/mol for discontinuous crack growth. The mechanism of nitrate stress corrosion in mild steel has been interpreted as anodic dissolution, and these results support this interpretation, except that an intergranular oxide is formed and the metal is not dissolved directly. If the stress intensity, K, increases, then the mode of crack growth is fracture of the intergranular oxide or the oxide-metal interface. Nevertheless, anodic dissolution is an inherent part of the process, but by the solid state reaction in the grain boundaries An initiation time is required even in precracked specimens, and this observation is attributed to the time required to form intergranular oxide. The suggested controlling mechanisms are dissolution of the intergranular oxide in specimens in which k decreases with crack length and grain-boundary diffusion of oxygen in specimens in which K increases. ERA

N78-22223# Aubert et Duval, Neuilly-sur-Seine (France).

MEDIUM AND HIGH RESISTANCE STEELS [ACIERS A MOYENNE ET HAUTE RESISTANCE]

R. Ravez Paris Assoc. Aeron. et Astronautique de France 1977

17 p In FRENCH Presented at the Colloq. on New Mater., Bordeaux, 20-22 Apr. 1977
(AAAF-NT-77-36; ISBN-2-7170-0461-0) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Some steels for aeronautical application are presented. The steels are classified according to their resistance: very high, high, or medium. The properties and applications of the most important steels of each group are discussed, with special emphasis on the new steels: 300 M (very high resistance), 25 HP 9-4 (high resistance), 17-4 PH (high resistance, stainless), and maraging stainless (high resistance). It is concluded that although in aeronautics the utilization of steels decreases because wherever possible they are replaced by lighter materials, steels are still useful, especially for the most critical components for which as yet no substitutes have been found. ESA

N78-22224# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.
APPLICATION OF RUPTURE MECHANICS TO THE SELECTION OF ALUMINUM ALLOYS [APPLICATION DE LA MECANIQUE DE LA RUPTURE A LA SELECTION DES ALLIAGES D'ALUMINIUM]
C. Bathias Paris Assoc. Aeron. et Astronautique de France 1977 34 p refs In FRENCH
(AAAF-NT-77-37; ISBN-2-7170-0462-9) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

Mechanical tests on aluminum alloys A-U461, A-Z56U, and A-U26N are presented. The residual resistance of thin layers, the fatigue fracturing, and the influence of excessive loads on fatigue fracturing were studied; the plastified zone and the sowing down of fracturing for an excessive load were measured. ESA

N78-23035# European Space Agency, Paris (France).
COMPARATIVE STUDY OF TWO NiAl-TYPE COATINGS ON IN 100 ALLOY: EFFECTS OF TITANIUM
Bernard Dupre, Pierre Steinmetz, Bernard Roques, and Robert Pichoir *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 17-40 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 213-229 Original report in FRENCH previously announced as A77-50438 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-22225 Princeton Univ., N. J.
FUNDAMENTAL INVESTIGATIONS OF THE LIQUID-INDUCED CRYSTALLIZATION OF POLYMERS Ph.D. Thesis
Peter James Makarewicz 1977 216 p
Avail: Univ. Microfilms Order No. 78-00268

Experimental and theoretical attempts were made at characterizing selected aspects of the general phenomenon of liquid induced crystallization of polymers, with primary emphasis on initially amorphous, unoriented poly-ethylene terephthalate (PET). Areas investigated included the morphology, diffusion, mechanical properties, fine structure, and crystallization kinetics of this particular crystallization mode. The nature of the liquid, the type of morphology it induced in the polymer, and its significant residual level trapped within PET following liquid induced crystallization were all shown to strongly effect the resultant mechanical behavior. Dissert. Abstr.

N78-22226 Wisconsin Univ., Madison.
SQUEEZING FLOWS OF POLYMERIC LIQUIDS Ph.D. Thesis
Roger John Grimm 1977 354 p
Avail: Univ. Microfilms Order No. 77-23711

An extensive experimental investigation was carried out on the flow of polymeric liquids squeezed between two parallel plates. The fluids were squeezed under the action of a step-function force applied normal to the plates. In this program, the decrease in distance between the plates was measured as a function of time for a range of applied forces, initial plate separations, and plate radii. Two theoretical developments were carried out. The first was a numerical technique for calculating plate separation including fluid inertia for a Newtonian liquid. The second theoretical development was the derivation of a perturbation equation for compressible Newtonian fluids. Dissert. Abstr.

N78-22227 Maryland Univ., College Park.
THE SYNTHESIS OF BIODEGRADABLE POLYAMIDES AND THE SYNTHESIS OF A LADDER POLYMER BY 1,3-DIPOLAR CYCLOADDITION OF A CYCLIC DINITRONE Ph.D. Thesis
Yueh-shiou Huang Wu 1977 201 p
Avail: Univ. Microfilms Order No. 7804505

It was demonstrated that regularly alternating polyamides made from glycine and epsilon-aminocaproic acid, and serine and epsilon-aminocaproic acid were biodegradable, other polyamides containing glycine and serine as part of the polymer chain were synthesized to investigate this concept. Thus,(poly/glycylimino/hexamethyleneimino/carbonyl/methyleneimino/adipoyl) was obtained by interfacial polycondensation of bis(2 aminocaetyl) 1,6-hexanediamine with adipoyl chloride. The polymer had an intrinsic viscosity of 0.67 dl/g at 25 deg dichloracetic acid and slowly decomposed when heated above 250 deg. The monomer, bis(2 aminoacetyl) 1,6-hexandiamine, was prepared from the reaction of ammonium hydroxide with bis(2 chloracetyl 1,6-hexanediamine which was in turn prepared from the reaction of chloracetyl chloride with 1, 6-hexandiamine. Dissert. Abstr.

N78-22228 Rensselaer Polytechnic Inst., Troy, N. Y.
AN ULTRASONIC METHOD FOR MEASUREMENT OF VISCOELASTIC PROPERTIES OF POLYMERIC SOLUTIONS Ph.D. Thesis
In-Young Koh 1977 168 p
Avail: Univ. Microfilms Order No. 7802856

The results of the high frequency limiting behavior of several polystyrene solutions (5%, 10%, 20%, 40%) together with steady-state viscosity results are reported. With these results the possible explanation of the contribution of polymer molecules to the total steady-state is presented. Dissert. Abstr.

N78-22229 Catholic Univ. of America, Washington, D. C.
POLARIZED RAYLEIGH SCATTERING: VISCOELASTICITY AND STRUCTURAL RELAXATION IN LUBRICANTS Ph.D. Thesis
Byron Edward Dom 1977 225 p
Avail: Univ. Microfilms Order No. 78-02580

This work applies standard techniques toward obtaining a viscoelastic characterization of two rather short chain polymer lubricants--a 50% substituted polymethylsiloxane (MPS-710) and a perfluoroalkylpolyether (Krytox 143AC). Digital time correlation spectroscopy scattering studies were carried out to obtain the viscoelastic relaxation function over a seven decade time range of 10 s to 10 s. Fabry-Perot spectral measurements of longitudinal and transverse Brillouin shifts gave the solid-like elastic moduli. Ultrasonic velocity measurements at atmospheric pressure yielded equilibrium compressibility data and density measurements as a function of pressure were performed to obtain its pressure dependence. The shear viscosity and the refractive index were studied as functions of temperature and pressure and specific heats were obtained as functions of temperature through the glass transition regions. Dissert. Abstr.

N78-22230# Lockheed Missiles and Space Co., Palo Alto, Calif.
CREEP OF POLYFLUOROETHYLENE RESIN UNDER SHEAR WITH THE IMPOSITION OF HYDROSTATIC PRESSURE
O. E. Olkhovik and A. IA. Goldman [1977] 8 p refs Transl. into ENGLISH from Mekhan. Polimerov (USSR), no. 5, 1977 p 812-818 Presented at the 3d All-Union Conf. on Polymer Mech., Riga, 1976
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A fundamental problem of the mechanics of polymer materials is the investigation of their behavior in a complex stress state. The development of research in this area permits computation

and predictions of the deformability and strength of a polymer structure with the actual state of stress taken into account. Investigations of the viscoelastic behavior of polymer materials under tension (compression) with the imposition of a hydrostatic pressure showed the presence of singularities, in principle, in the behavior of polymers as compared with other structural materials. The traditional hypotheses of the mechanics of a continuous medium (incompressibility condition, independent of the properties from the mean stress) which are well suited to metals and other materials, need experimental verification for application to polymers. From this point of view, the study of the deformativity of polymer materials under pure shear with the application of hydrostatic pressure is innvestigated. Author

N78-22231*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PROCESS FOR CURING EPOXIDES WITH DIAMINES Patent Application

Terry L. StClair and Vernon L. Bell, inventors (to NASA) Filed 29 Mar. 1978 10 p

(NASA-Case-LAR-11823-1; US-Patent-Appl-SN-891245) Avail: NTIS HC A02/MF A01 CSCL 11G

A process for curing epoxides and polyepoxides to produce stronger amine cured resins was developed. Isomeric diaminobenzophenones and diaminodiphenylmethanes which have amine groups located at ortho or meta positions to the carbonyl or methylene groups joining the two benzene rings to cure epoxide resins were used. The diamine selected may be melted, dissolved in a low boiling solvent or slurried in powder form into the liquid epoxide prepolymer. NASA

N78-22232*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE EFFECT OF MICROSTRUCTURE ON HYDROGEN EMBRITTLEMENT OF THE NICKEL-BASE SUPERALLOY, UDIMET 700

Hugh R. Gray 1978 32 p refs Presented at the 19th Struct., Structural Dyn. and Mater. Conf., Bethesda, Md., 3-5 Apr. 1978; sponsored by the AIAA and the Am. Soc. of Mech. Engr.

(NASA-TM-73772; E-9574) Avail: NTIS HC A03/MF A01 CSCL 11F

Material from a single heat of cast and wrought Udimet 700 was processed and/or heat treated to produce five material conditions with identical chemical compositions but with distinct microstructural variations, and then evaluated for susceptibility to hydrogen embrittlement. Two prealloyed powder conditions exhibited significantly improved resistance to hydrogen embrittlement, as compared to wrought material. No degradation in notch or smooth tensile strengths occurred, and average ductilities of 25 percent reduction of area were determined for 2 hydrogen evaluation procedures. For the most severe hydrogenation procedure, ductility levels were reduced to 15 percent. These improvements were attributed to cleaner grain boundaries and decreases grain size. Author

N78-22233*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

EVALUATION OF MATERIALS FOR HIGH PERFORMANCE SOLAR ARRAYS Status Report No. 1

A. F. Whitaker, C. F. Smith, Jr., C. L. Peacock, Jr., and S. A. Little Apr. 1978 41 p

(NASA-TP-1220; M-252) Avail: NTIS HC A03/MF A01 CSCL 11G

A program has been underway to evaluate materials for advanced solar arrays which are required to provide power to weight ratios up to 100 W/kg. Severe mission environments together with the lack of knowledge of space environmental materials degradation rates require the generation of irradiation and outgassing engineering data for use in the initial design phase of the flight solar arrays. Therefore, approximately 25 candidate array materials were subjected to selected mission environments of vacuum, UV, and particle irradiation, and their mechanical and/or optical properties were determined where appropriate. Author

N78-22234# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.

POLYMERIZATION OF SPIRO ORTHO ESTERS: PRELIMINARY KINETIC RESULTS Interim Report, Jul. 1976 - Jan. 1977

Hubert J. Booth 24 Aug. 1977 37 p refs

(ZR00001; ZR01102)

(AD-A050653; NSWC/WOL/TR-77-103) Avail: NTIS HC A03/MF A01 CSCL 07/3

Preliminary kinetic data have been obtained on a model spiro ortho ester. Spiro ortho esters are a class of monomers which have near zero shrinkage or even slight expansion when they polymerize. The concept of having expanding monomer systems is an important consideration in improving potting materials, adhesives, structural resins, and casting resins for industrial and military applications. The kinetic data to date indicates that competing side reactions occur during the polymerization of spiro ortho esters. The influence of these side reactions must be minimized by changes in temperature or catalyst in order to realize fully the potential of this class of materials.

Author (GRA)

N78-22235# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.

CHARGE-TRANSFER COMPLEXES AND THEIR ROLE IN COPOLYMERIZATION Final Report, 1 Sep. 1972 - 31 Sep. 1975

J. Radovic Wellinghoff and M. Litt Sep. 1977 146 p refs

(Grant DA-ARO(D)-31-124-73-G21)

(AD-A050911; ARO-10748.2-C; FR-1) Avail: NTIS HC A07/MF A01 CSCL 11/9

A new theoretical approach to charge-transfer complex formation is presented. The overall process is seen as a result of two processes; solvation and actual complexation, each having a distinct equilibrium constant. The complex concentration can be determined for any donor and solvent concentration. The theory is applied to the fumaronitrile/styrene complex in four solvents, with dielectric constants ranging from 2.24 to 24. Styrene and fumaronitrile polymerize with a pronounced alternating tendency. Since the two monomers also have very different polarities (epsilon values), they provide a convenient system to test the charge-transfer complex copolymerization model developed by Seiner and Litt. For this purpose two series of polymerizations were run: one in ethanol at low total monomer concentration (conditions unfavorable for the formation of the charge-transfer complex), the other in dichloroethane at high total monomer concentration (conditions favoring the charge-transfer complex). It is shown that the polymerization is both solvent and dilution dependent as predicted by the model. This dependence is related to charge-transfer complex concentrations. GRA

N78-22236# Naval Surface Weapons Center, White Oak, Md.

COMPATIBILIZATION OF POLYPHENYLQUINOXALINE WITH OTHER POLYMERS USING CHLOROFORM AS THE SOLVENT IN THE PREPARATION OF POLYMERIC MEMBRANES Compatibility Study Report, Dec. 1976 - Jun. 1977

Isaac Angres 16 Nov. 1977 13 p refs

(AD-A050638; NSWC/WOL/TR-77-118) Avail: NTIS HC A02/MF A01 CSCL 07/3

This work was performed to determine if polyphenylquinoxaline (PPQ) can be made compatible with other polymers such as polyvinylacetate, polyvinylpyrrolidone, vinylpyrrolidone/vinylacetate copolymer, cellulose acetate, cellulose triacetate, and polybrene. The primary purpose was to prepare homogeneous solution blends containing PPQ combined with one, two or three of the above polymers. Such solution blends were used to prepare polymeric membranes to be used as battery separators.

Author (GRA)

N78-22237# Ansul Co., Marinette, Wis.

ENVIRONMENTALLY IMPROVED AFFF Final Report

13 Dec. 1977 45 p refs

(Contract N00173-76-C-0295)

(AD-A050508) Avail: NTIS HC A03/MF A01 CSCL 13/12

This investigation was undertaken to try to gain some insights into how the chemical composition of aqueous film-forming foam (AFFF) concentrates effect the environmental properties of these fire extinguishing agents. Since this is a relatively new area of concern and interest, there will be differences of opinion in how

to approach the investigation. The contractor's original proposal and the final work statement are presented below for purposes of clarity in outlining the work and criteria used in this investigation. Author (GRA)

N78-22238# Arizona State Univ., Tempe.
THE SOLID STATE CHEMISTRY OF RARE EARTH OXIDES Final Report, 1 Sep. 1950 - 31 Jul. 1977
LeRoy Eyring Jul. 1977 24 p
(Contract E(11-1)-1109)
(COO-1109-87) Avail: NTIS HC A02/MF A01

Thermodynamic, kinetic and structural information on the complex rare earth oxides of praseodymium and terbium was obtained because these systems exhibit homologous series of ordered phases, order-disorder transformations, wide-range nonstoichiometric phases, chemical hysteresis in two phase regions and many other solid state reaction phenomena. The technique of high resolution transmission electron microscopy on crystals yielding images at about 3.5A resolution was applied to determine structural details almost at the atomic level on ordered materials, materials with defects (including extending defects) and on materials undergoing reaction in order to further clarify the accommodation of extended defects in materials. ERA

N78-22239# Sandia Labs., Albuquerque, N. Mex. Ceramics Development Div.
BEAM-BENDING METHOD FOR DETERMINING THE VISCOSITY OF GLASS
J. A. Gilbert 10 Aug. 1977 24 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0219) Avail: NTIS HC A02/MF A01

A beam bending method for measuring the viscosity (eta) of glass in the range of 109 to 1014 poise was evaluated. The glasses used were borosilicate formulations provided by the National Bureau of Standards (NBS) as viscosity standards. The evaluation was conducted using a DuPont thermal mechanical analyzer (TMA) which was fitted with a modified furnace and sample holder. In order to minimize temperature variations at the linear variable transformer, a water cooled invar jacket was constructed and adapted to the measuring system. With these modifications it was possible to measure viscosities to temperatures of 1000 C for as many as three samples per day. Measurements agreed to within 5 C of the NBS and were reproducible to within 5 percent. ERA

N78-22240# Avions Marcel Dassault, Saint-Cloud (France).
STUDIES ON REINFORCED PLASTICS [DEVELOPPEMENT DES ETUDES SUR LES PLASTIQUES RENFORCES]
Maurice Emont Paris Assoc. Aeron. et Astronautique de France 1977 20 p In FRENCH Presented at the Colloq. on New Mater., Bordeaux, 20-22 Apr. 1977
(AAAF-NT-77-40; DGT-11-393/A; ISBN-2-7170-0465-3) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Experience gained in the use of boron fiber composite coatings of the internal grid structure of the rudders of modern aircraft is presented. The coatings of such grids are exposed to both traction and compression. Boron was therefore chosen because of the excellent properties in compression of boron preimpregnated epoxies. It is concluded that in using boron coatings no major difficulties were encountered. ESA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N78-22241+ Paul Sabatier Univ., Toulouse (France). Lab. de Genie Electrique.
STUDY OF THE DETONATION OF SEMICONDUCTOR TYPE EXPLOSIVES. CASE OF CONDUCTING COMPOSITIONS [ETUDE DE L'AMORCAGE DES EXPLOSIFS A CARACTERE SEMICONDUCTEUR. CAS DES COMPOSITIONS CONDUCTRICES]
Feb. 1976 18 p In FRENCH
(Contract DRME-74/1153)
Avail: NTIS HC A02

The optimization of a pentrite aluminum detonator with initiation energy in the order of 0.1 Joule was studied. It is shown that the experimental cap produces detonation below 100 mJ (25nF - 2900 V or 50 nF - 2000 V) in a time less than 10 microseconds. ESA

N78-22242*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NITRAMINE SMOKELESS PROPELLANT RESEARCH Annual Research Progress Report, 1 Jul. 1976 - 30 Sep. 1977
N. S. Cohen (Cohen (Norman) Professional Serv., Redlands, Calif.) and L. P. Strand Nov. 1977 65 p refs
(Contracts NAS7-100; JPL-954715; AFOSR ISSA 7T-0002; AFOSR ISSA 77-0001)
(NASA-CR-156291; JPL-Pub-78-6) Avail: NTIS HC A04/MF A01 CSCL 21I

A transient ballistics and combustion model is derived to represent the closed vessel experiment that is widely used to characterize propellants. A computer program is developed to solve the time-dependent equations, and is applied to explain aspects of closed vessel behavior. In the case of nitramine propellants the cratering of the burning surface associated with combustion above break-point pressures augments the effective burning rate as deduced from the closed vessel experiment. Low pressure combustion is significantly affected by the ignition process and, in the case of nitramine propellants, by the developing and changing surface structure. Thus, burning rates deduced from the closed vessel experiment may or may not agree with those measured in the equilibrium strand burner. Series of T burner experiments are performed to compare the combustion instability characteristics of nitramine (HMX) containing propellants and ammonium perchlorate (AP)propellants. Although ash produced by more fuel rich propellants could have provided mechanical suppression, results from clean-burning propellants permit the conclusion that HMX reduces the acoustic driving. Author

N78-22243*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF FUEL PREPARATION SYSTEMS FOR AN AUTOMOTIVE GAS TURBINE CATALYTIC COMBUSTOR
Robert R. Tacina 1977 22 p refs Presented at the 2d Workshop on Catalytic Combust., Raleigh, N. C.; sponsored by EPA Prepared for DOE
(NASA-TM-78856; DOE/NASA-1011-78/23; E-9585) Avail: NTIS HC A02/MF A01 CSCL 21D

Spatial fuel distributions, degree of vaporization, pressure drop and air velocity profiles were measured. Three airblast injectors and an air-assist nozzle were tested. Air swirlers were used to improve the spatial fuel-air distribution. The work was done in a 12 cm tubular duct. Test conditions were: a pressure of 0.3 and 0.5 MPa, inlet air temperatures up to 800 K, air velocities of 10 20 m/s and fuel-air ratios up to 0.020. The fuel was Jet A. The best results were obtained with an airblast configuration that used multiple cones to provide high velocity air for atomization and also straightened the inlet airflow. With this configuration, uniform spatial fuel-air distributions were obtained with mixing lengths greater than 17.8 cm. In this length, vaporization of the fuel was 98.5 percent complete at an inlet air temperature of 700 K. The total pressure loss was 1.0 percent with a reference velocity of 20 m/s and 0.25 percent at 10 m/s. The air velocity was uniform across the duct and no autoignition reactions were observed. Author

N78-22244# Sandia Labs., Albuquerque, N. Mex. Reactor Theory and Analysis Div.
IMPORTANCE OF SCALE AND TRIGGERING EFFECTS IN VAPOR EXPLOSIONS
David C. Williams 27 Nov. 1977 6 p refs Presented at ANS Winter Meeting, San Francisco, 27 Nov. 1977
(Contract EY-76-C-04-0789)
(SAND-77-1101C; Conf-771109-16) Avail: NTIS HC A02/MF A01

Large scale coherent vapor explosions are shown in terms

of local interaction properties. The presence of a suitable triggering event in determining whether an explosion actually occurs on a particular occasion is noted. Certain small scale interaction properties are assumed to exist and the large scale system behavior these imply are explored. ERA

N78-22245# Institut Franco-Allemand de Recherches, St. Louis (France).
MASS SPECTROMETRIC AND TIME-OF-FLIGHT ANALYSIS OF GASEOUS DETONATION PRODUCTS IN HIGH VACUUM
A. Hoeh and F. Aulinger 2 Aug. 1977 15 p refs Presented at the Intern. Symp. on Dyn. Mass Spectrometry, Salford, Engl., 5-7 Jul. 1977
(ISL-CO-213/77) Avail: NTIS HC A02/MF A01

Gaseous products of the detonation of solid explosives (lead azide and PETN) expanding into high vacuum were analyzed using a molecular beam system and an off-axis quadrupole mass filter with separated ion source, ion deflector, and focusing lens in order to obtain information on the chemical components which can be found in the expanding gas cloud. The components nitrogen and lead for lead azide, hydrogen, water, nitrogen monoxide, and oxygen, and carbon dioxide for PETN are detected. It is remarkable that NO is not found in the final gas state. Velocity distributions of the molecules can be determined from their time of flight after the detonation. The leading edge of the expanding gas cloud consists of hydrogen with velocities up to 24 km s(-1). Assuming the model of a gas source moving at constant mass velocity and containing molecules of a Maxwellian velocity distribution, the freeze-out temperature during the gas expansion can be estimated. Author (ESA)

N78-22246# European Space Agency, Paris (France).
INVESTIGATIONS OF CATALYTIC DECOMPOSITION OF HYDRAZINE-AMMONIA MIXTURES
H. Koch and F. Kaempfer Feb. 1978 14 p refs Transl. into ENGLISH of 'Untersuch. zur katalytischen Zersetzung von Hydrazin-Ammoniak-Mischungen', DFVLR, Fassberg, West Ger. Report DLR-IB-456-77/6, 1977 Original report in GERMAN previously announced as N78-15299
(ESA-TT-451; DLR-IB-456-77/6) Avail: NTIS HC A02/MF A01

The time behavior of iridium catalyst in contact with various hydrazine-ammonia mixtures in comparison with pure hydrazine was studied as part of a research program on high energy rocket propulsive systems. Hydrazine-ammonia mixtures in comparison with hydrazine have a lower melting point and a reduced decomposition and explosion risk. Investigations show that the production of fission gasses depends in the first instance on the ammonia content. Also, the lifetime of the catalysts depends strongly on the ammonia content. Propellant mixtures with ammonia content up to 30%, reaction times of over 300s are attainable, especially when the reaction chamber which contains the catalyst material is evacuated before the start. ESA

N78-22247# European Space Agency, Paris (France).
PRIMARY AND SECONDARY COMBUSTION CHAMBER IN COMBINATION PROPULSION WITH BORON AS PROPELLANT
A. Boussios Feb. 1978 11 p refs Transl. into ENGLISH of 'Primaer- u. Sekundaerbrennkammerprozesse bei Kombinationsantrieben mit Bor als Brennstoff', DFVLR, Fassberg, West Ger. Report DLR-IB-456-77/7, 1977 Original report in GERMAN previously announced as N78-15300
(ESA-TT-452; DLR-IB-456-77/7) Avail: NTIS HC A02/MF A01

The application of boron as aircraft propellant was studied. It is shown that the ignition and combustion in the afterburner could be achieved at a boron particle temperature as low as 600 K. To this end the boron particles must be injected in the rocket engine behind the flame front and the reaction products must have the water vapor content necessary for the combustion. The decrease of the particle temperature leads to a reduction of the required percentage of additional propellant. Consequently, the boron weight percentage could be increased to 86%. Tests with non gaseous N2O4-N2H4 as additive instead of H2-O2-N2 show equivalent results. ESA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-22248 California Inst. of Tech., Pasadena.
OPTIMAL DESIGN OF DISTRIBUTED PARAMETER MEASUREMENT SYSTEMS Ph.D. Thesis
Sudarshan Kumar 1978 138 p
Avail: Univ. Microfilms Order No. 7801533

The optimal sensor location problem was approached from the point of view of estimation theory. The objective chosen was the estimation of the system state variables with maximum possible accuracy. An upper bound for the error covariance of the state estimate was derived. Optimal sensor locations were determined by minimizing this upper bound of the error covariance. This approach offers significant savings in computation time over the conventional approaches based on direct minimization of the error covariance. A one dimensional heat conduction system was considered as an example. The effect of process dynamics on optimal sensor locations was studied in detail for that example. The optimal locations were found to vary for spatially varying measurement noise. Dissert. Abstr.

N78-22249# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 34
25 Apr. 1978 73 p refs Transl. into ENGLISH from various Russian journals
(JPRS-71006) Copyright. Avail: Issuing Activity

Information on some of the following topics was reported in relation to Soviet technology utilization: (1) Direction finding of spatially distributed sources using an instantaneous signal comparison technique; (2) Laser vibratory gyroscopes; (3) The use of structural redundancy to increase the accuracy measurement of absolute angular velocity; and (4) Comments on future orbital complexes. For individual titles, see N78-22250 through N78-22255.

N78-22250 Joint Publications Research Service, Arlington, Va.
DIRECTION FINDING OF SPATIALLY DISTRIBUTED SOURCES USING AN INSTANTANEOUS SIGNAL COMPARISON TECHNIQUE **c32**
V. G. Solonenko *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 21-29 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Radioelekron. (Kiev), vol. 21, no. 1, 1978 p 45-51 (For availability see N78-22249 13-31)
Copyright. Avail: Issuing Activity

Expressions were derived for generalized direction finding and fluctuation characteristics of a sum difference type system using instantaneous signal comparison for a complex radiation source. The results can be employed for system analysis in a broad class of radar situations, signal waveforms and structures and types of targets. Author

N78-22251 Joint Publications Research Service, Arlington, Va.
LASER VIBRATORY GYROSCOPE **c35**
A. A. Golovan and A. V. Salmin *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 30-35 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Priborostr. (Leningrad), no. 1, 1978 p 58-62 (For availability see N78-22249 13-31)
Copyright. Avail: Issuing Activity

The possibility of significant attenuation of the effect of parameter drift of the sensing element used on the accuracy of recording the absolute angular velocity by modulation of the useful signal was considered on an example of a laser vibratory gyroscope. Comparative analysis of the measuring conversion conductance and the signal noise ratio of a vibratory gyroscope based on a ring laser and an oscillator type vibratory gyroscope was made. Author

N78-22252 Joint Publications Research Service, Arlington, Va.
THE USE OF STRUCTURAL REDUNDANCY TO INCREASE THE ACCURACY OF MEASUREMENT OF ABSOLUTE

ANGULAR VELOCITY **c35**
M. S. Davydov and A. A. Potapov *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 36-40 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Priborostr. (Leningrad), no. 11, 1977 p 74-77 (For availability see N78-22249 13-31)
Copyright. Avail: Issuing Activity

A study was made of the possibility of increasing the accuracy of operation of a system of gyroscopic two stage angular rate sensors by the corresponding orientation of the sensors and construction of an optimal (in the sense of minimum steady error dispersion) invariant algorithm for processing the information supplied by the sensors. Author

N78-22253 Joint Publications Research Service, Arlington, Va.
A GENERAL ALGORITHM FOR AN ANALYTIC METHOD OF GYROCOMPASSING **c35**
V. V. Seregin *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 41-47 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Priborostr. (Leningrad), no. 11, 1977 p 77-83 (For availability see N78-22249 13-31)
Copyright. Avail: Issuing Activity

A generalized algorithm for an analytic method of gyrocompassing for the case of a nonmoving base was introduced. The conditions of rotations of the input axis of the measuring transducer by the optimal angles were fulfilled, and demonstrated a method of conversion from the algorithm to particular actualizations. Expressions are also presented for the errors characterizing all of the particular cases studied. Author

N78-22254 Joint Publications Research Service, Arlington, Va.
THE MUTUAL ORIENTATION OF TWO THREE-AXIS GYROSTABILIZED PLATFORMS FOR SYSTEMS WITH INDEPENDENT ERROR DETECTION **c35**
V. L. Frolov *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 48-53 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Priborostr. (Leningrad), no. 11, 1977 p 83-88 (For availability see N78-22249 13-31)
Copyright. Avail: Issuing Activity

The mutual orientation of two three-axis gyrostabilized platforms, measuring the angular position of an object in a system with independent error detection was studied. The components of the six quaternions characterizing the possible orientation of the two three-axis gyrostabilized platforms relative to each other are found. Author

N78-22255 Joint Publications Research Service, Arlington, Va.
ZAYTSEV COMMENTS ON FUTURE ORBITAL COMPLEXES **c12**
Yu. Zaytsev *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 54-56 Transl. into ENGLISH from Trud (Moscow), 21 Mar. 1978 p 4 (For availability see N78-22249 13-31)
Avail: Issuing Activity

The development and possible uses of a Soviet orbital station were discussed in detail. Emphasis was placed on large multipurpose orbital stations for a crew of 100 men or more, effective for carrying out prolonged and extensive experimentation. Orbital assemblage accomplished by means of a special flight assembly apparatus was also examined. The idea of creating artificial gravity onboard such vehicles to enhance living conditions of the crew was reviewed. B.B.

N78-22256 Princeton Univ., N. J.
EARTH ANCHORS: LOAD TRANSFER ANALYSIS USING PHOTOELASTIC, ANALYTIC AND FINITE ELEMENT METHODS Ph.D. Thesis
Luis Arturo Prieto-Portar 1978 371 p
Avail: Univ. Microfilms Order No. 7804555

The factors that contribute to the pull out resistance of earth anchors was studied. A review of earth anchors is presented with special attention to investigations into the anchor load capacity. A program of experimental and theoretical analysis that clarifies the local transfer mechanisms between the anchor and the soil is described. The experimental program employed photoelastic models that described the elastic load transfer distribution between the anchor and the soil. The anchor shaft was shown to be the main mechanism of load transfer. A finite element program (ANKORDES) was developed to model prototype anchor behavior. It incorporates nonlinear material behavior and in situ soil stresses. It was first shown to produce reasonable agreement with the photoelastic experimental results. ANKORDES was then used to predict prototype anchor behavior. Dissert. Abstr.

N78-22257*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLIED ROUTH APPROXIMATION
Walter C. Merrill Apr. 1978 40 p refs
(NASA-TP-1231; E-9114) Avail: NTIS HC A03/MF A01 CSCL 12B

The Routh approximation technique for reducing the complexity of system models was applied in the frequency domain to a 16th order, state variable model of the F100 engine and to a 43d order, transfer function model of a launch vehicle boost pump pressure regulator. The results motivate extending the frequency domain formulation of the Routh method to the time domain in order to handle the state variable formulation directly. The time domain formulation was derived and a characterization that specifies all possible Routh similarity transformations was given. The characterization was computed by solving two eigenvalue-eigenvector problems. The application of the time domain Routh technique to the state variable engine model is described, and some results are given. Additional computational problems are discussed, including an optimization procedure that can improve the approximation accuracy by taking advantage of the transformation characterization. Author

N78-22258*# Lake shore Cryotronics, Inc., Columbus, Ohio.
SURVEY REPORT ON THE STATE-OF-THE-ART OF CRYOGENIC THERMOMETRY AND SIGNAL CONDITIONERS AND THEIR POTENTIAL FOR STANDARDIZED SPACE HARDWARE
Mar. 1978 86 p refs
(NASA Order A-44925-B)
(NASA-CR-152102) Avail: NTIS HC A05/MF A01 CSCL 20L

The possibility of standard low temperature detector(s) for use in upcoming cryogenically cooled satellite and Space Shuttle Payloads was investigated. These payloads operate from .3 Kelvin to 300 Kelvin. Standard detectors were selected and matching signal conditioning equipment were specified. This equipment will operate in a spacecraft environment and be compatible with the selected detector, typical spacecraft voltages, typical spacecraft telemetry systems, and the radiation encountered by a typical earth orbiting spacecraft. Work statements to better define and advance detector performance are presented. Author

N78-22259# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
INVESTIGATION OF UTILIZING STATIC DEHUMIDIFICATION CONCEPTS IN VANS AND SHELTERS Final Report, May 1975 - Dec. 1977
Daryl A. Edwards Jan. 1978 17 p
(AFPEA Proj. 76-P7-3)
(AD-A050796; PTPD-78-2) Avail: NTIS HC A02/MF A01 CSCL 13/4

Static free breather dehumidification systems have been continually experimented with for over thirty years. Its potential has been demonstrated but never effectively implemented within the Air Force. At this time of high cost impact and no active military engagements, proper long term storage must be achieved to maintain an effective defense. Static free breather dehumidification systems will help satisfy this requirement. Author (GRA)

N78-22260# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
RECENT PROGRESS IN THE DYNAMIC PLASTIC BEHAVIOR OF STRUCTURE Interim Report
Norman Jones Jan. 1978 66 p refs
(Contract N00014-76-C-0195)
(AD-A050810; OE-78-1) Avail: NTIS HC A04/MF A01 CSCL 13/12

This article attempts to review the literature on the dynamic

plastic response of structures published during the last three years, since the last survey by the author was published in the Shock and Vibration Digest(1). The review focuses largely on the behavior of simple structural components such as beams, plates and shells subjected to dynamic loads which produce extensive plastic flow of the material. In particular, recent work on the behavior of ideal fiber-reinforced beams, higher modal response of beams, the influence of transverse shear and rotatory inertia, approximate methods of analysis, rapidly heated structures, fluid-structure interaction and dynamic plastic buckling are discussed in detail. These topics are followed by a discussion of a few recent numerical studies on the dynamic plastic response of structures, and a brief survey of some recent experimental and theoretical investigations into the collision protection of vehicles. Author (GRA)

N78-22261# Electricity Council Research Center, Capenhurst (England).
THE VARIABILITY OF CONTRAST RENDERING FACTOR IN LIGHTING INSTALLATIONS
P. R. Boyce Aug. 1977 76 p refs
(PB-276607/9; ECRC/N-1020) Avail: NTIS
HC A05/MF A01 CSCL 13A

Contrast Rendering Factor (CRF) is a measure of the extent to which the light distribution of lighting installation makes a task visible relative to a standard lighting condition. A series of measurements of CRF by two methods are described for ten different two dimensional targets at ten position in ten lighting installations representative of office lighting practice. It is shown that two conditions are necessary for a low CRF value to occur: a high luminance region in the offending zone i.e. in the zone of the boundary surface of the interior that would be seen if the target were replaced by a small mirror, and a target with a specular reflection component. GRA

N78-22262# National Bureau of Standards, Washington, D. C. Center for Building Technology.
A NEW LOOK AT WINDOWS
Belinda L. Collins, Rosalie T. Ruegg, Robert Chapman, and Tamami Kusuda Jan. 1978 41 p refs
(PB-276747/3; NBSIR-77-1388) Avail: NTIS
HC A03/MF A01 CSCL 13A

Information on thermal loads, daylighting, management, and life cycle costs which indicate that such recommendations may neglect important design and operational aspects of windows which can conserve energy resources and reduce life cycle building costs is presented. A case example is described in which energy consumption and life cycle costs are given for windows in a typical house in the Washington, D. C. area. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N78-22263 Illinois Univ., Urbana-Champaign.
BINARY SEQUENCES FOR SPREAD-SPECTRUM MULTIPLE-ACCESS COMMUNICATION Ph.D. Thesis
Henricus Franciscus Albertus Roefs 1977 132 p
Avail: Univ. Microfilms Order No. 78-04133

The communication capacity of a single wideband satellite channel could be simultaneously shared by a number of users by means of spread-spectrum multiple-access (SSMA). In phase-coded SSMA, the multiple-access capability was provided by phase modulating a distinct signature sequence onto the user's carrier which spreads the user data over a wide bandwidth. All of the important code parameters for the analysis of such a system could be derived from the aperiodic correlation functions of the signature sequences. The asymptotic behavior of such code parameters was considered for random binary sequences for which the sequence length grows very large. New sets of pseudo random or m sequences with optimal aperiodic autocorrelation and cross-correlation properties were obtained. The relationship between the first few central moments of the aperiodic correlation functions and the characteristic polynomials generating the m-sequences was analyzed, and the results were compared with actual sequence data. Dissert. Abstr.

N78-22264 Purdue Univ., Lafayette, Ind.
THE DESIGN OF DIGITAL SINGLE-SIDEBAND MODULATORS USING A MULTIRATE DIGITAL FILTER Ph.D. Thesis
Craig Robert Williams 1977 231 p
Avail: Univ. Microfilms Order No. 78-03299

The translation from time-division-multiplexed (TDM) data formats to frequency-division-multiplexed (FDM) data formats was considered. Three methods of efficiently implementing the translation are presented. These methods represent three types of digital single sideband modulation. It is shown that the design of the three translators can be reduced to designing a computationally efficient form of a multirate digital filter. Seven forms of implementing the miltirate digital filter were developed. The coefficient bit length requirements of the seven forms were compared. The parallel forms are shown to be the least sensitive to coeffficient errors. However, it was noted that the direct forms were not so sensitive as to be impractical to implement. This was significant because single rate, direct form filters with narrow passbands and sharp transition regions are usually much too sensitive to coefficient errors to be considered practical. Dissert. Abstr.

N78-22265 Johns Hopkins Univ., Baltimore, Md.
ROBUST DETECTION OF SIGNALS IN NOISE Ph.D. Thesis
Abdel-Rahman Hussein El-Sawy 1978 151 p
Avail: Univ. Microfilms Order No. 78-06248

The problem of nonsequential and sequential robust detection of signals in noise is solved under the assumption that the noise distribution is unknown but a member of a known class of symmetric density functions. In the nonsequential problem, a general procedure for the design of detectors which are asymptotically robust in maximin sense was introduced. A detector was designed for the special case when the noise distribution is a member of the class of p-point distributions and simulation results which show the robustness of this detector for finite sample sizes is provided. In the sequential problem, four general procedures for the design of robust sequential detectors were introduced. Two of these procedures, (the MS and SAS detectors) are more likely to be utilized in application than the others. Dissert. Abstr.

N78-22266 California Univ., Los Angeles.
THE DESIGN OF SAMPLED-DATA ALL-PASS SYSTEMS WITH LINEARLY VARYING GROUP-DELAY CHARACTERISTICS Ph.D. Thesis
Roubik Gregorian 1977 480 p
Avail: Univ. Microfilms Order No. 78-06487

The design and analysis of pulse compression and pulse stretching systems based on discrete time signal processing methods is analyzed. The approximation methods of linear group delay, all pass discrete time networks were discussed first. A new point by point matching technique was introduced. A maximally flat approximation was implemented and the results of both methods optimized by a computer aided error minimization technique. A new error reduction method was introduced. An iterative point matching method was introduced which is applicable to any group delay characteristic for both discrete and continuous time systems. The contribution of a second order all pass filter section to the overall group delay of the system was investigated, and the results were used to estimate the necessary degree of a linear delay filter with a prescribed compression ratio. Dissert. Abstr.

N78-22267*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
SPACELAB UPLINK/DOWNLINK DATA FLOW AND FORMATS
F. Kandefer 15 Feb. 1978 388 p refs
(Contract NAS9-15014)
(NASA-CR-151677; JSC-12033) Avail: NTIS
HC A17/MF A01 CSCL 17B

The results of an analysis of the Spacelab (SL) data uplink/downlink structure and those data system elements associated with the support of this data flow are presented. Specific objectives of this report are to present the results of the following analyses: (1) operations of the SL high rate multiplexer, including format structure, data rates, format combinations, format switching, etc.; (2) operations of SL data recorders to include the definition of modes, data rates and forms; (3) operations of the high rate demultiplexer as described above; (4) potential experiment data formats defining formatting parameters to be considered in decommutation analysis; (5) SL computer input/output (I/O) decommutation channels, including the definition of structure, quantity and use of this I/O data; (6) detailed requirements of the data quality monitoring philosophy for this function. Author

N78-22268*# National Aeronautics and Space Administration. Pasadena Office, Calif.

AUTOMATIC COMMUNICATION SIGNAL MONITORING SYSTEM Patent Application

Albert J. Bernstein, inventor (to NASA) (JPL) Filed 4 Mar. 1977 19 p

(Contract NAS7-100)

(NASA-Case-NPO-13941-1; US-Patent-Appl-SN-774384) Avail: NTIS HC A02/MF A01 CSCL 17B

A system for automatic monitoring of a communication signal in the RF or IF spectrum utilizes a superheterodyne receiver technique with a VCO to select and sweep the frequency band of interest. A first memory is used to store one band sweep as a reference for continual comparison with subsequent band sweeps. Any deviation of a subsequent band sweep by more than a predetermined tolerance level produces an alarm signal which causes the band sweep data temporarily stored in one of the two buffer memories to be transferred to long-term store while the other buffer memory is switched to its store mode to assume the task of temporarily storing subsequent band sweeps. In a second embodiment, the roles of the two buffer memories are switched at the end of each heterodyne receiver band sweep for display of successive band sweeps at a faster rate and for automatic long-term store of any band sweep producing an alarm. NASA

N78-22269*# Ohio State Univ., Columbus. ElectroScience Lab.

POWER LAW RELATIONSHIPS FOR RAIN ATTENUATION AND REFLECTIVITY

D. M. J. Devasirvatham and D. B. Hodge Jan. 1978 19 p refs

(Contract NAS5-23850)

(NASA-CR-156742; ESL-784650-2) Avail: NTIS HC A02/MF A01 CSCL 20N

The equivalent reflectivity, specific attenuation and volumetric backscatter cross section of rain are calculated and tabulated at a number of frequencies from 1 to 500 GHz using classical Mie theory. The first two parameters are shown to be closely approximated as functions of rain rate by the power law aR to the b power. The a's and b's are also tabulated and plotted for convenient reference. Author

N78-22270*# LinCom Corp., Pasadena, Calif.

KU-BAND SIGNAL DESIGN STUDY Final Report

Izhak Rubin 15 Apr. 1978 206 p refs

(Contract NAS9-14846)

(NASA-CR-151709; TR-7804-0476) Avail: NTIS HC A10/MF A01 CSCL 17B

Analytical tools, methods and techniques for assessing the design and performance of the space shuttle orbiter data processing system (DPS) are provided. The computer data processing network is evaluated in the key areas of queueing behavior synchronization and network reliability. The structure of the data processing network is described as well as the system operation principles and the network configuration. The characteristics of the computer systems are indicated. System reliability measures are defined and studied. System and network invulnerability measures are computed. Communication path and network failure analysis techniques are included. Author

N78-22271*# Axiomatix, Marina del Rey, Calif.

INTEGRATED SOURCE AND CHANNEL ENCODED DIGITAL COMMUNICATION SYSTEM DESIGN STUDY Final Report

Waddah K. Alem, Gaylord K. Huth, and Marvin K. Simon 31 Mar. 1978 8 p refs

(Contract NAS9-15240)

(NASA-CR-151700; R7803-7) Avail: NTIS HC A02/MF A01 CSCL 17B

The particular Ku-band carrier, PN despreading, and symbol synchronization strategies, which were selected for implementation in the Ku-band transponder aboard the orbiter, were assessed and evaluated from a systems performance viewpoint, verifying that system specifications were met. A study was performed of the design and implementation of tracking techniques which are suitable for incorporation into the Orbiter Ku-band communication system. Emphasis was placed on maximizing tracking accuracy and communication system flexibility while minimizing cost, weight, and system complexity of Orbiter and ground systems hardware. The payload communication study assessed the design and performance of the forward link and return link bent-pipe relay modes for attached and detached payloads. As part of this study, a design for a forward link bent-pipe was proposed which employs a residual carrier but which is tracked by the existing Costas loop. Author

N78-22272*# Texas Instruments, Inc., Dallas. Dept. of Space Systems.

DESIGN AND DEMONSTRATION OF AN ADVANCED DATA COLLECTION/POSITION LOCATION SYSTEM Final Report, Aug. 1976 - Jul. 1977

Jul. 1977 175 p refs

(Contract NAS5-23599)

(NASA-CR-156748) Avail: NTIS HC A08/MF A01 CSCL 17B

The final report on a breadboard evaluation and demonstration program is reported concerning the applicability of MSK modulation and chirp-z transformer technology in Advanced Data Collection/Position Location (ADC/PL) systems. The program effort consisted of three phases - design, testing, and evaluation. Section 2 describes the breadboard hardware built during the design phase of the program, Section 3 describes the tests conducted on the breadboard and the results of the tests, and Section 4 presents a brief analysis and summary of the findings of the breadboard tests and develops a sample ADC/PL system which incorporates both MSK modulation and a chirp-z transformer. Author

N78-22273# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.

ADAPTIVE SPREAD SPECTRUM RECEIVER USING SAW TECHNOLOGY

P. Das, D. R. Arsenault, and L. B. Milstein 15 Sep. 1977 8 p refs

(Grant DAAG29-77-G-0205)

(AD-A050659; MA-ARO-1; ARO-15004.2-EL) Avail: NTIS HC A02/MF A01 CSCL 17/2

A spread spectrum receiver implemented with surface acoustic wave (SAW) technology is discussed, and experimental results for the detection of a signal embedded in narrow band interference are presented. An adaptive version of that receiver is also discussed for the case of detecting a signal in the presence of a wideband Gaussian (but not necessarily white) interferer whereby an attempt is made to estimate the unknown noise spectral density. Author (GRA)

N78-22274# Georgia Inst. of Tech., Atlanta. Engineering Experimental Station.

ELECTROMAGNETIC SHIELDING OF STRUCTURAL FOAMS BY USING INTERNAL CONDUCTIVE MATERIALS Interim Report, 14 Feb. - 14 Aug. 1977

D. G. Bodnar Jan. 1978 54 p refs

(Contract DAAG46-77-C-0027; DA Proj. 1L1-62105-AH-84) (AD-A050817; AMMRC-TR-78-2) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report summarizes the preliminary analysis performed during the first phase of the program to assess the RF shielding effectiveness obtainable by using internal conductive materials in structural foams. The major emphasis was on the use of

carbon/graphite fibers as the conductive material although consideration was given to metalized glass fibers and to metal particles. Several mathematical analysis techniques were considered for assessing shielding effectiveness including the method of moments, wire grid analysis, meteorological, and plane wave analysis. The plane wave analysis technique was deemed the most applicable. Calculations are presented of shielding effectiveness in the HF through UHF frequency range for various material characteristics. Recommendations are also presented on test panels that should be fabricated during the second phase of the program to verify the theoretical predictions. Author (GRA)

N78-22275# Naval Ocean Systems Center, San Diego, Calif.
NOSC MODEL DLM-1 SYNCHRONOUS/ASYNCHRONOUS DATA-LINE MONITOR/ANALYZER Research and Development Report, Jan. - Aug. 1977
Raymond L. Mitchell, Jr. 19 Dec. 1977 32 p
(AD-A050838; NOSC/TR-194) Avail: NTIS HC A03/MF A01 CSCL 09/2

A data-line monitor, under microprogram control, is described and its application in monitoring activities on serial data lines linking a computer with remote terminals is discussed. Synchronous protocols are accommodated by the monitor and additional protocols may be obtained by minimal software changes. Author (GRA)

N78-22276# IIT Research Inst., Annapolis, Md.
PERFORMANCE OF VOICE COMMUNICATIONS SYSTEMS IN THE PRESENCE OF SPREAD SPECTRUM INTERFERENCE Final Report
Leonard Farber and J. Cormack Dec. 1977 76 p refs
(Contract F19628-78-C-0006)
(AD-A050844; ESD-TR-77-005) Avail: NTIS HC A05/MF A01 CSCL 17/2

A computer simulation model developed for determining the manner in which undesired spread spectrum signals affect the performance of conventional narrowband AM and FM voice communication systems is described. Direct-sequence, frequency-hopping and hybrid, frequency-hopping/direct-sequence, spread spectrum interference signals were modeled. Binary phase shift keying and minimum-shift keying were included for the carrier modulation of the direct-sequence signals and the direct-sequence portion of the hybrid signals. In addition to the spread spectrum interference, pulsed interference and white Gaussian noise were modeled. Using articulation index as the measure of performance, comparisons are made between system performance for direct-sequence interference and white Gaussian noise. System performance for frequency-hopping or frequency-hopping/direct-sequence interference is compared with that for pulsed interference. Author (GRA)

N78-22277# TDR, Inc., Los Angeles, Calif.
NUMERICAL INVESTIGATION OF PLANE WAVE PULSE SCATTERING BY DIELECTRIC OBSTACLES/DETAILED RESULTS FOR A DIELECTRIC SLAB MODEL OF THE ATLAS 1 TRESTLE PLATFORM Final Report
A. D. Varvatsis, S. G. Siegel, and M. I. Sancer Oct. 1977 97 p refs
(Grant AF-AFOSR-3010-76)
(AD-A050969; AFOSR-78-0209TR) Avail: NTIS HC A05/MF A01 CSCL 20/14

A system of time dependent integral equations are derived and then are analytically demonstrated to be capable of treating scattering by a dielectric interface. A finite difference method is demonstrated to be capable of determining the fields scattered by an obstacle having an edge, by comparing a numerical solution to a canonical solution for scattering by a perfectly conducting wedge. Both methods are applied to the dielectric platform which has both a dielectric interface as well as an edge. The results obtained are in close agreement and chosen to generate production data for ATLAS I related parameters by employing the finite difference method; however, this should not be taken as an endorsement that this method is always preferable. As part of the investigation problems are identified for which either method would be preferred. Finally, time dependent plots of the electric field at points in the working volume are presented that show the amount of distortion caused by the platform. GRA

N78-22278# Syracuse Univ., N. Y. Dept. of Electrical and Computer Science.
DETERMINATION OF CAVITY FIELDS EXCITED BY AN ELECTROMAGNETIC PULSE THROUGH AN APERTURE Interim Report, 1 May 1976 - 31 Oct. 1977
David K. Cheng 31 Dec. 1977 54 p refs
(Grant AF-AFOSR-3002-76)
(AD-A050977; TR-77-14; AFOSR-78-0208TR) Avail: NTIS HC A04/MF A01 CSCL 20/3

The state space technique is used to formulate the transient electromagnetic problem of excitation of a rectangular cavity through an aperture. Depending on whether the E- or the H-formulation is used, the effect of the aperture can be accounted for by a magnetic current in invoking the induction theorem or by an electric current in invoking the equivalence theorem. The governing second-order differential equation is converted into a set of first-order state equations by defining three new state variables in addition to an appropriate vector potential. These state equations are solved by the method of moments. Two cases are considered: parallel polarization and perpendicular polarization. Some significant singularities for the parallel-polarization case are found and the electric intensities as functions of time at two locations in the cavity are computed for a step excitation. An alternative approach of expanding the cavity fields in terms of TM and TE cavity modes is developed to reduce the dimension of the system matrix. Numerical difficulties are encountered and possible contributing causes are discussed. Author (GRA)

N78-22279# Lincoln Lab., Mass. Inst. of Tech., Lexington.
STORE-AND-FORWARD COMPUTER COMMUNICATIONS OVER NOISY CHANNELS
David J. Leinweber Dec. 1977 30 p refs
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A051053; TR-525; ESD-TR-77-299) Avail: NTIS HC A03/MF A01 CSCL 09/2

A model is developed for a computer communications processor with large storage capacity. The model follows single message positive acknowledgment protocol wherein the transmitting node acquires messages from the external environment, transmits them to the receiver, and awaits acknowledgment. Special attention is given to modeling the effects of transmission errors, either in the message or the acknowledgment, upon the service time of the computer communications network. These effects of error have generally been ignored in previous investigations. In order to realistically account for the service time distributions found in actual computing systems, which have bounded domains, an analysis of M/G/1 queueing servers with service times of this sort was necessary. This analysis (Appendix) focuses upon servers with uniform service times, and those whose service time distributions can be approximated by a section of a normal distribution. Author (GRA)

N78-22280# Rome Air Development Center, Griffiss AFB, N.Y.
DIGITAL SMOOTHING BUFFER Technical Reports, Jul. 1976 - Sep. 1977
David L. Wortley Feb. 1978 26 p refs
(AD-A050655; RADC-TR-77-391) Avail: NTIS HC A03/MF A01 CSCL 17/2

Asynchronous time division multiplexers (ATDM's) typically produce large phase excursions as a result of bit stuffing operations. Analog phase locked loops (PLL) are normally employed to smooth these excursions to levels which can be accepted by various sink equipments. For ATDM's which cover a broad range of rates, such as the AN/GSC-24, it is difficult to provide a high level of smoothing across the entire range due to noise and frequency limitations. This project investigated a digital PLL as a potential technique for circumventing the analog limitations. A digitally implemented PLL has the potential of providing extended smoothing across a broad range of rates as smoothing becomes a function of the number of stages of circuitry implemented. The constraints on the project were to determine if a digital second order PLL could be implemented on an AN/GSC-24 size circuit card which would be capable of providing a slew rate of less than 2 pi radians over a 20,000 bit interval. It was determined that this slew rate goal could be reached over a wide range of data rates but high frequency phase jitter and size limitation have made it undesirable for AN/GSC-24 use. Author (GRA)

N78-22281# Range Commanders Council, White Sands Missile Range, N. Mex. Telecommunications Group.
TEST METHODS FOR TELEVISION SYSTEMS AND SUBSYSTEMS Final Report
Jul. 1977 275 p
(AD-A050586; TCG-134-77) Avail: NTIS HC A12/MF A01 CSCL 17/2

The purpose of this technical report is to provide definitions, standards and test procedures which can be directly, or in concept, applied to the testing of television systems and subsystems used with range instrumentation. This report is intended to clarify and/or augment existing government and industry standards and procedures where instrumentation applications are unique or where test ranges would benefit from a commonality of test procedures. Those procedures which can be defined, as they apply to specific instrumentation systems will be extracted and published as IRIG standards when such standards are deemed desirable. Author (GRA)

N78-22282*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ELECTRICAL INTERFERENCE TO SATELLITE SUBSYSTEMS RESULTING FROM SPACECRAFT CHARGING Progress Report
Robert R. Shaw Feb. 1978 30 p refs Presented at 1978 Symp. on the Effect of the Ionosphere on Space and Terrestrial Systems, Washington, D. C., 25 Jan. 1978
(Grant NGL-16-001-043; Contract N00014-76-C-0016)
(NASA-CR-156501; AD-A050601; U-of-Iowa-78-6) Avail: NTIS HC A03/MF A01 CSCL 20/3

A physically reasonable mechanism for explaining the coupling between one type of spacecraft electronics subsystem and electrical discharges has been presented. A laboratory simulation of the coupling to the signal processing electronics has shown quantitative agreement between the test results and the anomalous detector responses that have been observed in orbit. The results of this study and experimental flight data collected by a satellite-charging experiment flown on this spacecraft confirm that these anomalies are likely generated by direct current surges from arc discharges. Author (GRA)

N78-22283# Syracuse Univ., N. Y.
DESIGN OF SKEWED ISOPHASORS OF ELECTROMAGNETIC EMITTERS Phase Report, Mar. - Sep. 1977
Tapan Kumar Sarkar Dec. 1977 48 p refs Prepared in cooperation with Rochester Inst. of Tech., N. Y.
(Contract F30602-75-C-0121)
(AD-A050753; RADC-TR-77-423) Avail: NTIS HC A03/MF A01 CSCL 09/5

The magnitude of the slope of skewed isophasor lines from electromagnetic emitters is shown to be directly related to the physical distance between the geometric center of the spatially distributed electromagnetic emitters and the projected phase center obtained by extrapolation of the skewed isophasor lines. It is shown that the slope of the isophasor lines not only depends on the excitations of the electromagnetic emitters but also on the inter-emitter spacing. Finally, an optimization method is utilized to obtain the excitations for a set of spatially distributed electromagnetic emitters for a specified slope of the isophasor lines, a fixed number of electromagnetic emitters and for a given minimum inter-emitter spacing. Author (GRA)

N78-22284# Mission Research Corp., Santa Barbara, Calif.
ON THE EXCITATION OF AXIALLY SYMMETRIC MODES OF A CYLINDRICAL CAVITY FOR HIGH FLUENCE SGEMP SIMULATION Topical Report, Oct. 1976 - Oct. 1977
Roger Stettner Oct. 1977 42 p refs
(Contract DNA001-77-C-0009)
(AD-A050769; AD-E300088; MRC-R-302; DNA-4207T) Avail: NTIS HC A03/MF A01 CSCL 20/3

This excitation of the axially symmetric modes of a cylindrical tank are considered for circumstances which approximate those of a highly space-charge-limited SGEMP situation. The amplitudes of excitation are discussed from both a general point of view and with specific reference to the Physics International tank used with the Owl II photon source. Author (GRA)

N78-22285# Naval Ocean Systems Center, San Diego, Calif.
COVERT COMMUNICATIONS BETWEEN PATROL AIRCRAFT IN RENDEZVOUS: MILLIMETRE-WAVE AND ELECTROOPTICAL TECHNOLOGIES COMPARED WITH UHF LINK 4 FOR P-3 TO P-3 HAND-OVER IN A MARITIME ENVIRONMENT Final Report
L. B. Stotts, R. T. Kihm, R. L. Mather, M. E. Hyde, and G. C. Mooradian 8 Nov. 1977 121 p refs
(AD-A050771; NOSC/TR-174) Avail: NTIS HC A06/MF A01 CSCL 17/2

In response to the fleet operational requirement for covert hand over between two P-3 patrol aircraft engaged in maritime surface/subsurface surveillance, trade-offs were addressed between two separate communication systems designed for such service - the first based on millimetre-wave technology, the other on electro-optical technology. Under the most ideal interception conditions, millimetre-wave and electro-optical technologies give comparable performance levels and both restrict communication to significantly lower maximum detectable range than do present UHF communication techniques. Author (GRA)

N78-22286# European Space Research and Technology Center, Noordwijk (Netherlands).
ANTENNA ARRAYS APPLIED TO COMMUNICATIONS SATELLITES
A. Roederer Paris ESA Nov. 1977 32 p refs
(ESA-TM-176) Avail: NTIS HC A03/MF A01

The use of multibeam arrays for mobile communication satellites and its impact on system performance are discussed. In the case of communications with small mobile terminals (e.g. aircraft, ships, spacecraft), the gain of the antenna system must be optimized in order to relieve the small terminals of costly gain and/or power requirements. Designs involving reflector antennas provide relatively low gains, and significant improvement (typically 6 db) can be obtained by using arrays. Complexity is increased, but so is flexibility. Frequency re-use becomes possible and graceful degradation is assured. The front end constituents are described, and the problems related to the array are discussed, including those of element selection, performance prediction, and measurements. Typical examples are given to show the improvements expected from the use of arrays on communication satellites. Growth potential of such systems and related critical areas are discussed. Author (ESA)

N78-22287# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT, NO. 34
21 Apr. 1978 67 p refs Transl. into ENGLISH from various journals
(JPRS-70994) Avail: NTIS HC A04/MF A01

Translations are presented from the world press and radio relating to worldwide political, economic, and technical developments in telecommunication, computers, and satellite communication. Coverage was worldwide with focus on France, Federal Republic of Germany, United Kingdom, Italy, Japan, USSR, People's Republic of China, Sweden, and Netherlands. For individual titles, see N78-22288 through N78-22288.

N78-22288 Joint Publications Research Service, Arlington, Va.
OPTICAL FIBER TRANSMISSION SYSTEMS IN LOW-LOSS 1.0-1.7 uM WAVE LENGTH REGION
Tatsuya Kimura and Kazuhiro Daikoku *In its* Translations on Telecommunications Policy, Res. and Develop., No. 34 (JPRS-70994) 21 Apr. 1978 p 8-26 refs Transl. into ENGLISH from Denshi Tsushin Gakki Shi, (Japan), v. 60, no. 12, Dec. 1977 p 1379-1386 (For availability see N78-22287 13-32)
Avail: NTIS HC A04/MF A01

Low OH optical fibers were used. Results of basic studies on optical transmission modes in the long wavelength region above 1.0 uM and the associated optical parts are described. The use of low OH optical fiber made possible a large increase in the distances between relay stations, as a result of which a relay station could be located in a local station rather than in a manhole, and improved reliability and economy could be anticipated. This change in the conditions for relay station siting was also advantageous from the standpoints of construction and maintenance. At the same time, the power transmission

accompanying optical cable transmission was rendered unnecessary. The use of low OH optical fiber retained the features and advantages of optical transmission modes of the past with no changes. Author

N78-22250 Joint Publications Research Service, Arlington, Va.
DIRECTION FINDING OF SPATIALLY DISTRIBUTED SOURCES USING AN INSTANTANEOUS SIGNAL COMPARISON TECHNIQUE
V. G. Solonenko *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 21-29 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Radioelekron. (Kiev), vol. 21, no. 1, 1978 p 45-51 (For availability see N78-22249 13-31)
Copyright. Avail: Issuing Activity

N78-22600# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
NEAR-FIELD MEASUREMENTS OF RF FIELDS
Paul S. Ruggera *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 104-116 ref (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-22289 California Univ., Irvine.
ON THE STRUCTURE OF LINEAR SYSTEMS Ph.D. Thesis
Adly Tadros Fam 1977 77 p
Avail: Univ. Microfilms Order No. 78-01456

The structural properties of linear, time invariant, discrete, and continuous time systems are investigated in the presence of perturbations of arbitrary magnitude in the system parameters and also in the presence of changes in the structure of the input and/or output sets. Parametric perturbations that have no effect on system input-output behavior are considered. A new relationship is established between this class of perturbations and the system state space in a way that sheds new insights into the intrinsic nature of controllability and observability. Dissert. Abstr.

N78-22290 Illinois Univ., Urbana-Champaign.
DECENTRALIZED STACKELBERG STRATEGIES FOR INTERCONNECTED STOCHASTIC DYNAMIC SYSTEMS Ph.D. Thesis
Suvalai Pratishthananda Glankwamdee 1977 102 p
Avail: Univ. Microfilms Order No. 78-04000

A two level sequential decision formulation for the control of interconnected stochastic linear discrete-time systems is investigated. An interconnection of several systems is considered, whereby each subsystem has a decision maker and an associated quadratic cost function. One of the decision makers is designated as a leader or coordinator and his control strategies were to be chosen prior to those of the others. The second level decision makers were regarded as followers in the context of Stackelberg strategies. Their strategies were in accordance with the Nash equilibrium concept or Pareto optimal concept except that the coordinator's strategy is known to all of them. The coordinator chooses his strategy under the assumption that the followers will fully exploit the prior announcement of his strategy. Centralized and decentralized information are considered. Dissert. Abstr.

N78-22291 Maryland Univ., College Park.
AN INTEGRABLE MOS NEURISTOR LINE: DESIGN, THEORY AND EXTENSIONS Ph.D. Thesis
Chhaya Kulkarni Kohli 1977 109 p
Avail: Univ. Microfilms Order No. 78-04499

The line is designed such that it consumes no power during the resting state. The basic form of the line was next extended to form bilateral lines and to ones transmitting positive and negative pulses. Experimental results on actual MOS neuristor lines were given, to illustrate the properties. The equations for the proposed designs were presented in a compact form by developing a one function volt-ampere relationship for the nonlinear MOS transistor. These equations were verified numerically to possess the neural properties. Next, an important property of the neuron, namely, its rhythmic responses to steady stimuli, and their frequency variation with stimulus intensity, was shown to be simulated by the proposed MOS neural lines, for a proper choice of the line parameters. Dissert. Abstr.

N78-22292 Oregon State Univ., Corvallis.
HYBRID, HIGH SPEED FAULT DETECTION BASED ON INSTANTANEOUS LINE VOLTAGES Ph.D. Thesis
Hiranand Balchand Ramchandani 1978 70 p
Avail: Univ. Microfilms Order No. 78-03845

A fault detection scheme based on sampling the instantaneous phase voltages and checking their sum and magnitude against a specified voltage was examined. Faults on the system cause unbalances and distortion of the phase voltages and currents. The currents and voltages change in magnitude and/or phase position with respect to the prefault condition. The measurement of this deviation from the normal condition indicates a fault. The scheme detected the fault within one half cycle (8 milliseconds) in the laboratory. It was shown that the scheme is simpler and faster to implement than conventional detection schemes. Dissert. Abstr.

N78-22293 Illinois Univ., Urbana-Champaign.
ANISOTROPY, BIREFRINGENCE, AND DISPERSION IN ARTIFICIAL DIELECTRICS Ph.D. Thesis
William Forrest Richards 1977 210 p
Avail: Univ. Microfilms Order No. 78-04126

Thin obstacle artificial dielectrics are investigated using a full wave analysis. The artificial dielectrics consist of a number of uniformly or nonuniformly spaced, parallel layers, each layer consisting of periodically arranged thin metallic obstacles. The fields scattered by one layer are expanded in a complete set of space harmonics. The propagating and least attenuating of these space harmonics are then considered as the fields interacting on neighboring layers. The interaction of this finite set of space harmonics is modeled by a set of transmission lines and the mode conversion of these harmonics by the obstacles in each layer is modeled by interconnecting the transmission lines to multiport lumped linear networks. The refractive index is defined in terms of the eigenvalues of the infinite three dimensional periodic structure. An efficient wide-band approximation is formulated for computing refractive index for a dielectric with disk obstacles. Dissert. Abstr.

N78-22294 Michigan Univ., Ann Arbor.
PROPERTIES OF SEMICONDUCTOR MATERIALS AND MICROWAVE TRANSIT-TIME DEVICES Ph.D. Thesis
Paul Eugene Bauhahn 1977 277 p
Avail: Univ. Microfilms Order No. 78-04645

The effects of material parameters on the performance of various IMPATT device structures was studied. After a theoretical study of the transport characteristics of GaAs and InP, several computer simulation programs were developed and used to examine the operation of IMPATT diodes. Several very economical explicit, implicit and hybrid computer programs were developed to simulate transit time devices under static, small signal and large signal conditions. IMPATT diodes were simulated using various materials and parameters to determine the optimum designs for devices employing Si, GaAs and InP in X band Read type structures. Dissert. Abstr.

N78-22295 Florida Univ., Gainesville.
COMPARISON OF CONTINUUM AND DOMAIN MODELS FOR MAGNETIZATION PROCESSES IN PERMALLOY THIN FILM SEGMENTS Ph.D. Thesis
Ernst Huijer 1977 228 p
Avail: Univ. Microfilms Order No. 78-06711

A continuum model using Fourier series was developed and applied to the calculation of magnetization distributions in permalloy I bars. Results of these calculations were presented

and compared with some theoretical and experimental results. Fourier series were applied to determine the magnetostatic field distribution from a bubble domain and the resulting magnetization distribution in the I bar. A case of special interest for the analysis of bubble logic devices and of the influence of nearby propagation tracks was the interaction between two bubbles through the medium of the overlay. Domain patterns were observed using the Bitter technique. Two basic patterns are distinguished in demagnetized bars and their change under the influence of an applied field was observed. Dense domain patterns arising in bars after partial saturation were analyzed and interpreted. Dissert. Abstr.

N78-22296 Wayne State Univ., Detroit, Mich.
A NUMERICAL ANALYSIS OF BIAS-INDUCED SWITCHING PHENOMENA IN THIN AMORPHOUS CHALCOGENIDE FILMS Ph.D. Thesis
Khaja Fareeduddin Subhani 1977 211 p
Avail: Univ. Microfilms Order No. 7805231

An electrothermal bias induced critical field switching model for amorphous chalcogenide materials is numerically studied and current voltage and voltage time characteristics are emphasized. Numerical techniques were developed for solving nonlinear, nonhomogeneous elliptic and nonlinear parabolic equations representing electric and heat current flow in three dimensions. A purely electronic model is also discussed that accounts for the unique switching properties of chalcogenides. Equal densities of positively and negatively charged traps were neutralized by excess carriers produced by field induced multiplication. A transition from the low conductivity OFF state to the high conductivity ON state occurs when all the charged traps are filled. Various other properties of the device were modeled and the electronic origin of the switching effect firmly established. Dissert. Abstr.

N78-22297*# DCA Reliability Lab., Sunnyvale, Calif. Special Products Div.
JAN TRANSISTOR AND DIODE CHARACTERIZATION TEST PROGRAM: JANTX DIODE 1N759A Final Report
Hiro Takeda Mar. 1977 14 p
(Contract NAS8-31944)
(NASA-CR-150670) Avail: NTIS HC A02/MF A01 CSCL 09A

The necessary data to create a new class of specifications was the objective of this characterization program. Sample selection was made according to the following criteria: (1) manufacturer or qualified distributor; (2) two vendors; and (3) two date codes. The general guidelines for procurement were two QPL vendors, JAN or JANTX, and two manufacturing lots, 27 from each lot. All data were acquired with three digit accuracy. The data processing and calculation of statistical parameters were performed by the Tektronix computer system using 4 digit display. Author

N78-22298*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SYSTEM FOR AUTOMATICALLY SWITCHING TRANSFORMER COUPLED LINES Patent Application
William S. Dwinell, inventor (to NASA) (Rockwell Intern., Downey, Calif.) Filed 9 Mar. 1978 10 p
(Contract NAS9-14000)
(NASA-Case-MSC-16697-1; US-Patent-Appl-SN-885067) Avail: NTIS HC A02/MF A01 CSCL 09C

A system is provided for automatically controlling transformer coupled alternating current electric lines. The secondary winding of each transformer is provided with a center tap. A switching circuit is connected to the center taps of a pair of secondary windings and includes a switch controller. An impedance is connected between the center taps of the opposite pair of secondary windings. The switching circuit has continuity when the AC lines are continuous and discontinuity with any disconnection of the AC lines. Normally-open switching means are provided in at least one AC line. The switching controller automatically opens the switching means when the AC lines become separated. NASA

N78-22299*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MODULE FAILURE ISOLATION CIRCUIT FOR PARALLELED INVERTERS Patent Application
Satoshi Nagano, inventor (to NASA) (JPL) Filed 9 Feb. 1978 13 p
(Contract NAS7-100)
(NASA-Case-NPO-14000-1; US-Patent-Appl-SN-876431) Avail: NTIS HC A02/MF A01 CSCL 09C

A circuit is proposed which detects current occurring in each module of a multimodule paralleled inverter system and compares it with the average current of all the modules to determine when there is a failure in any one module, and to shut down the failing module. Such a failure isolation circuit is useful in power conditioning systems for spacecraft, data processing systems, and the like, and for all forms of solar energy conversion systems. NASA

N78-22300*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TEMPORAL STRUCTURE OF RF RADIATION FROM LIGHTNING
David M. LeVine Apr. 1978 23 p refs Submitted for publication
(NASA-TM-78113) Avail: NTIS HC A02/MF A01 CSCL 09C

Radiation from lightning in the RF band from 3-300 MHz has been examined. Simultaneous measurements were made of the RF radiation from lightning together with records of fast and slow field changes. Continuous analogue recordings were made with a system having 300 kHz of bandwidth in the RF channels. The temporal history of RF radiation of these frequencies consists of a sequence of discrete pulses. The data reveal a distinct pattern in the radiation which is independent of frequency and depends on the type of lightning flash: Cloud-to-ground flashes are characterized by an abrupt beginning associated with the stepped leader, whereas cloud-to-cloud flashes begin with a slower train of noise pulses more typical of the end of both types of flash. An exception to this pattern is cloud-to-ground flashes preceded by a breakdown phase, in which case the radiation begins like a cloud-to-cloud flash. Author

N78-22301# Electrotechnical Lab., Tokyo (Japan).
BREAKDOWN CHARACTERISTICS UNDER STEEP-FRONT IMPULSE VOLTAGES
Katsumasa Takagi Dec. 1977 257 p refs In JAPANESE; ENGLISH summary
(Rept-774) Avail: NTIS HC A12/MF A01

A method of generating steep front impulse high voltage and a method of its precise measurement was developed in order to qualitatively and quantitatively analyze the mechanism of flashover and breakdown characteristics of distribution apparatuses and establish the foundation of a fundamental insulation design concept of distribution apparatuses against steep-front surges that takes into account the steep wave component caused by lightning stroke in the neighborhood of distribution lines. The flashover characteristics in the air, surface flashover characteristics, and puncture characteristics of solid dielectrics, which are considered to constitute fundamental factors of insulation design on line apparatuses are discussed. Author

N78-22302# Rome Air Development Center, Griffiss AFB, N.Y.
A REDUNDANCY NOTEBOOK
Jerome Klion Dec. 1977 68 p refs
(AD-A050837; RADC-TR-77-287) Avail: NTIS HC A03/MF A01 CSCL 14/4

The objective of the report is to present in a coherent fashion the information and tools necessary for the evaluation of most types of redundancy design configurations with which a reliability engineer is faced. The report contains a number of alternative evaluation approaches, both classical and unique. Closed form results and algorithms are derived for the evaluation of the reliability of various types of redundant configurations. Author (GRA)

N78-22303# Varian Associates, Palo Alto, Calif.
IMPROVED DUAL-MODE ELECTRON GUN Final Technical Report, Apr. - Dec. 1976
Fredrik Bjornstad Dec. 1977 39 p
(Contract F30602-76-C-0177)
(AD-A050842; RADC-TR-77-411) Avail: NTIS

HC A03/MF A01 CSCL 09/1

An advanced non-intercepting gridded gun was designed, fabricated, and preliminary tested. The use of magnetic flux in the cathode region preserves the beam diameter when the grid voltage is reduced for a lower power mode of operation. This will result in a more stable TWT performance, since the gain difference associated with the two modes is significantly reduced. Author (GRA)

N78-22304# Martin Marietta Aerospace, Orlando, Fla.
CRIMP CONNECTION RELIABILITY Final Technical Report, Sep. 1977
Donald F. Cottrell and Thomas E. Kirejczyk Griffiss AFB, N. Y. RADC Jan. 1978 52 p refs
(Contract F30602-76-C-0438; AF Proj. 2338)
(AD-A050505; OR-14888; RADC-TR-78-15) Avail: NTIS HC A04/MF A01 CSCL 09/2

Martin Marietta has conducted a 12 month program to collect and analyze crimp connection reliability data. More than 3.8 billion part hours of data were collected. A failure rate mathematical model for crimp connections has been developed for inclusion in MIL-HDBK-217B. Also included in the report is a discussion of the physical characteristics of crimped connections and guidelines for their selection and application. Author (GRA)

N78-22305# Watkins-Johnson Co., Scotts Valley, Calif.
HIGH CONTRAST CRT Interim Technical Report, 1 Jan. - 30 Apr. 1977
Norman H. Lehrer Jan. 1978 42 p refs
(Contract DAAB07-77-C-2639; DA Proj. 1L1-62705-AH-94)
(AD-A050673; ECOM-77-2639-1) Avail: NTIS HC A03/MF A01 CSCL 09/1

The objective of this program is the development of a three inch, high contrast, two color CRT employing evaporated thin film phosphors. The initial green layers fabricated on CRT faceplates under this program exhibit luminous efficiencies approximately 25% of those previously achieved on layers fabricated on sapphire. This reduction results from the lower processing temperature required for use with the Type 1723 glass faceplates. Type 1720 glass originally envisioned for use in this effort and capable of higher temperature processing than 1723 glass was not available at the start of the program. Faceplates of 1723 glass and funnels of 7052 glass have been ordered to build and study fabrication problems. Data taken on the laminarflo gun in a three inch monochrome CRT indicates that the gun can achieve current densities on the order of 12 A/sq cm at a screen potential of 12 kV and therefore should easily satisfy the requirements for a current density of 1 to 2 A/sq cm at 10 to 20 kV to achieve the required brightness. Author (GRA)

N78-22306# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
RELIABILITY STUDY OF DOPED ALUMINUM CONDUCTOR FILMS Final Technical Report, May 1976 - Aug. 1977
James Black Dec. 1977 111 p refs
(Contract F30602-76-C-0300)
(AD-A050677; RADC-TR-77-410) Avail: NTIS HC A06/MF A01 CSCL 09/1

A reliability study of silicon doped aluminum conductor films for semiconductor device use is presented. The solid state dissolution process of silicon in aluminum is discussed and the morphology of etch pits that can form in silicon due to these processes are described. Processes for depositing Al/Si alloy films are briefly mentioned and the structure of the films as deposited and after various heat treatments is studied. The electromigration failure mode of metal induced by high current densities and temperatures is presented along with the results of previous studies of pure aluminum, other aluminum alloys and aluminum silicon alloys. Current results on low temperature (- 210 C) studies of small grained and glassed Al/Si alloys indicate that they fail by an electrical open circuit due to the growth of voids resulting from the electromigration of Al in Al. GRA

N78-22307# Martin Marietta Aerospace, Orlando, Fla.
DEVELOPMENT OF NONELECTRONIC PART CYCLIC FAILURE RATES Final Technical Report, Sep. 1976 - Sep. 1977
George F. Guth Dec. 1977 104 p refs
(Contract F30602-76-C-0437)
(AD-A050678; OR-14841; RADC-TR-77-417) Avail: NTIS HC A06/MF A01 CSCL 14/4

A 12 month program to develop base failure rates and failure rate mathematical models for relays, switches, and connectors was conducted. These models are provided in the format of MIL-HDBK-217B and include the model and instructions for its use. More than 10 billion part-hours of operating field data were collected from industrial and government data sources. Data was analyzed manually and sorted by computer. Conclusions are summarized in the revised base failure rates and mathematical models described. Failure rates for connectors and switches show a significant decrease from present rates, for relays, show a marginal decrease. A mating factor, pi sub K, has been developed for the connector model, and a stress factor has been added to the switch model. GRA

N78-22308# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ASSESSMENT OF CABLE RESPONSE SENSITIVITY TO CABLE AND SOURCE PARAMETERS IN LOW FLUENCE X-RAY ENVIRONMENTS Topical Report, Jan. - Apr. 1977
David M. Clement and Charles E. Wuller 8 Apr. 1977 42 p
(Contract DNA001-77-C-0084)
(AD-A050703; AD-E300092; DNA-4407T) Avail: NTIS HC A03/MF A01 CSCL 09/1

The direct injection response of satellite cables to low fluence X ray environments has been analyzed with respect to certain cable parameters and photon source parameters. Cable parameters considered were the following: conductor materials, conductor flashing, number of conductors, gap sizes, shield thickness, dielectric material, cable size, characteristic impedance, cable type, and cable loads. Source parameters considered were spectra and angle of incidence. The most sensitive cable parameter was gap size. It was found that cable response was fairly insensitive to black-body spectra, at least within the ranges of black-body spectra considered. Author (GRA)

N78-22309# Sylvania Electronic Systems-West, Mountain View, Calif.
UHF FIELD-EFFECT-TRANSISTOR MIXER OF HIGH DYNAMIC RANGE
David M. Hodsdon Dec. 1969 57 p refs
(Contract DAAB07-68-A-0503)
(AD-A050617; SESW-G821; ECOM-0503-P005-G821-68)
Avail: NTIS HC A04/MF A01 CSCL 09/5

A study is presented of theoretical and experimental performance of a 90-degree-hybrid-coupled FET mixer covering 500-1000 MHz. The theoretical work completed includes methods for calculating FET mixer gain, noise figure, third-order intermodulation, and harmonic intermodulation products (single-frequency spurious responses). A model suitable for use in mixer design is also described. Test data from the experimental model of the mixer, over the frequency range of 500 to 1000 MHz, indicated a noise figure of 10.9 to 13.3 db, gain of 2.8 to 5.6 db, and a 3-db-gain-compression level of -6 dbm at the input. The intermediate frequency was 160 MHz, with a bandwidth of a 4 MHz. Good correlation between calculated and measured performance was obtained. In addition, there is described a computer program, written in FORTRAN IV for the IBM 1130 and automating the calculations required to estimate FET mixer performance, in which curvative effects up through the ninth order are included. Some comparison is made of the test results with typical hot-carrier diode mixers which, in the 500 to 1000 MHz range, are comparable except for their conversion losses. GRA

N78-22310# RCA Labs., Princeton, N. J.
RADIATION EFFECTS ON THE ELECTRICAL PROPERTIES OF MOS DEVICE MATERIALS Final Report 2 Mar. 1976 - 28 Feb. 1977
Gary Hughes Feb. 1978 71 p
(Contract DAAG39-76-C-0088; DNA-MIPR-76-654)
(AD-A050785; PRRL-77-CR-37) Avail: NTIS HC A04/MF A01 CSCL 20/12

Radiation-hard SiO2 on Si grown by three different processes

(dry, pyrogenic steam, and hybrid) has been examined by vacuum ultraviolet techniques. Flatband shift vs time measurements provide estimates of capture cross sections and trap densities. Current-enhancement measurements provide qualitative information about trapping at both the Si-SiO2 and gate-SiO2 interface. Results show that unannealed dry oxides have the lowest interface-state density after irradiation, making them more desirable for applications where switching speed is important. Annealing in argon at 800 C increases both the hole-trap and interface-state density. All dry oxides have a dominant trap with capture cross section S approx. = 5 x 10 to the -14th power sq cm at applied oxide fields E sub 0 = 1 MV/cm. Pyrogenic steam oxides have many more interface states after irradiation than dry oxides and can be characterized by a dominant trap with S approx. 5 x 10 the the -14th power to 10 to the -13th power sq cm = for E sub 0 = 1 MV/cm. Hybrid oxides grown in 3% HCl steam followed by dry O2 show S approx. 2 x 10 to the -13th power sq cm at E sub 0 = 1 MV/cM. The larger capture cross section for these oxides is believed to be due to the presence of HCl. All oxides show a neutral trap capture cross section which is approximately inversely proportional to the applied oxide field. Both pyrogenic steam and dry hard oxides can be characterized by the same trap. The difference between the two oxides appears to be only the density of interface states. Author (GRA)

N78-22311# Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.

INVESTIGATION OF FACTORS INVOLVED IN RELIABILITY ASSURANCE OF PLASTIC-ENCAPSULATED INTEGRATED CIRCUITS Final Report, 1 Nov. 1976 - 1 Nov. 1977

John L. Prince, III 8 Feb. 1978 44 p refs
(Grant DAAG29-77-G-0039)
(AD-A050875; ARO-14722.1-R-EL) Avail: NTIS HC A03/MF A01 CSCL 09/2

Upper temperature limits to accelerated stress testing of plastic-encapsulated integrated circuits were determined and evidence of chip-encapsulant interaction was obtained. Possible yield-reliability correlations were considered and alternatives to MIL-M-38510 screening were discussed for plastic-encapsulated IC's. Author (GRA)

N78-22312# Colorado Univ., Boulder.

RANDOM GAIN AND PHASE ERROR EFFECTS IN OPTIMAL ARRAY STRUCTURES Technical Report, 1 Oct. 1976 - 31 May 1977

Charles W. Jim (Colorado Univ., Boulder) and Lloyd J. Griffiths (Colorado Univ., Boulder) Sep. 1977 46 p refs
(Contract N00014-75-C-0930)
(AD-A050919; EE-77-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report summarizes a quantitative analysis of the effects of random gain and phase errors and angular variations on the performance of a class of Least-Mean-Square (LMS) optimal array processors. Two different structures for the LMS optimal array processor were studied. Both belong to a general class of side-lobe cancelling arrays and both structures employed a conventional beamformer as an integral part of the structure. The first implemented a linear constraint using software and the second employed a simple spatial hardware preprocessor to implement the same constraint. An analysis of the sensitivity of both LMS optimal array processors as well as a conventional beamformer to random gain and phase errors was performed. GRA

N78-22313# Los Alamos Scientific Lab., N. Mex.

VACUUM INTERRUPTERS USED FOR THE INTERRUPTION OF HIGH dc CURRENTS

R. W. Warren 1977 6 p refs Presented at the 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-2356; Conf-771029-44) Avail: NTIS HC A02/MF A01

Conventional ac vacuum interrupters were used to interrupt currents in pulsed energy storage systems. They were tested with dc currents of up to 37 kA. The limit to the current which can be successfully interrupted was measured as a function of various parameters. Among these are the size of the interrupter, the magnitude of the counterpulse current, the nature and flux rating of the saturable reactor used, and the kind of snubber circuit used. Fragmentary data were collected on electrode erosion rates and on mechanical failure of the bellows. A description is given of the circuits used in these tests and of the results found for a representative selection of the commercially available domestic interrupters. More recently efforts were made to increase the values found for the maximum interruptible current. The techniques used have included connecting interrupters in parallel and operating them in an impressed axial magnetic field. ERA

N78-22314# Sandia Labs., Albuquerque, N. Mex. Interconnections Div.

SOLDER FUSED INTERCONNECTIONS IN MULTILAYER CIRCUITS

George Voida Feb. 1977 31 p refs
(Contract E(29-1)-789)
(SAND-77-0197) Avail: NTIS HC A03/MF A01

A new solder fusion process was developed for production of multilayer cables and multilayer printed wiring boards. The multilayer process consists of three steps: (1) the photo-etching fabrication of the basic flexcircuit, (2) the lamination bonding of several flexcircuit layers together, and (3) solder fusion interjoining of the exposed lands to provide electrical continuity. In the solder fusion process the multilayer assembly is never in contact with highly reactive chemicals which, if entrapped, can lead to corrosion and dielectric breakdown of the assembly. A multilayer assembly produced by solder fusion can be shaped into three-dimensional configurations. The repeatable electrical continuity of solder fused interconnections in multilayer assemblies was confirmed by microhm resistance testing. ERA

N78-22315# General Atomic Co., San Diego, Calif.

HIGH CURRENT SWITCHES IN THE DOUBLET III POLOIDAL FIELD CIRCUIT

Eugene L. Woods and P. Wildi Oct. 1977 21 p refs Presented at the 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977
(Contract EY-76-C-03-0167-038)
(GA-A-14597; Conf-771029-136) Avail: NTIS HC A02/MF A01

Two types of high current switches are described: a single pole fast making (closing) switch, and a two pole fast breaking (opening) switch. The switches were built to provide switched high currents in the Doublet III poloidal (E-coil) field circuit. The fast-make switch was designed to carry 204 kA for 110 ms, and the fastbreak switch was designed to carry 110 kA for 315 ms. Both switches are pneumatically operated and can be tripped without transferring and valves, thus permitting low jitter and rapid contact transfer. The switches use a contact design that avaoids contact arcing and minimizes inductance. Contact pressure, in both switch concepts, is enhanced by the electromagnetic forces of the current passing through the switch. ERA

N78-22733# Joint Publications Research Service, Arlington, Va.

SPECIFICATIONS OF NEW ELECTRONIC INSTRUMENTS, INTEGRATED CIRCUITS AND SOLID STATE DEVICES

In its Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., no. 29 (JPRS-70659) 21 Feb. 1978 p 56-64 Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 12, Dec. 1977 p 31-34 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

N78-23043# Joint Publications Research Service, Arlington, Va.

ELECTRONIC PRODUCTS DEVELOPED AT COMMUNICATIONS RESEARCH INSTITUTE

In its Transl. on Eastern Europe (JPRS-70992) 21 Apr. 1978 p 13-17 Transl. into ENGLISH from Magy. Orszag (Budapest), no. 6, 5 Feb. 1978 p 20 (For availability see N78-23040 13-99)
Avail: NTIS HC A04/MF A01

N78-23044# Joint Publications Research Service, Arlington, Va.

FAIRCHILD CONTRACT FOR MASS PRODUCTION OF

INTEGRATED CIRCUITS
In its Transl. on Eastern Europe (JPRS-70992) 21 Apr. 1978 p 18-24 Transl. into ENGLISH from Hiradastech. (Budapest), no. 12, 1978 p 385-387 (For availability see N78-23040 13-99)
Avail: NTIS HC A04/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-22316 Utah Univ., Salt Lake City.
COMPUTATIONAL FLUID DYNAMICS: FINITE DIFFERENCE AND FINITE ELEMENT APPROACH Ph.D. Thesis
Anthony Dick Kau Au 1977 165 p
Avail: Univ. Microfilms Order No. 78-00891

In an attempt to design a general purpose computer program for fluid dynamic analysis, the finite difference and the finite element methods of solution to the complete Navier-Stokes equations, expressed in the primitive variables, were developed. The applications of the computational fluid dynamic methods in two biomedical engineering investigations showed the significance of hemodynamic parameters in relationship to the failure of prosthetic devices and circulatory dysfunctions. Dissert. Abstr.

N78-22317 Pittsburgh Univ., Pa.
PARAMETER ESTIMATION AND PREDICTION BY KALMAN FILTERING METHOD WITH APPLICATIONS TO OPEN CHANNEL FLOW AND STREAM TEMPERATURE MODELING Ph.D. Thesis
Emmanuel Oko Isu 1977 217 p
Avail: Univ. Microfilms Order No. 78-01886

Traditional or conventional approaches to the solution of hydraulic or water quality problems in general are deterministic. The uncertain and stochastic nature of such physical phenomena, process or systems through uncertainty characterization of the mathematical model parameters is emphasized. The estimates of these parameters are accomplished through Kalman filtering and its extensions. The method utilizes a state-space representation approach for formulating the system model equations, governing the state variables to be estimated and the observation model equation, relating measurements data to the state variables in the presence of noise, disturbance, or inherent uncertainty. The method allows for an interaction between the system and observation models through sequential state estimation and error propagation algorithms. Dissert. Abstr.

N78-22318 Illinois Inst. of Tech., Chicago.
THE EFFECT OF CONTINUOUS PHASE VISCOSITY ON THE DYNAMICS OF LIQUID-LIQUID DISPERSIONS IN AGITATED VESSELS Ph.D. Thesis
Michael Stamatoudis 1977 110 p
Avail: Univ. Microfilms Order No. 78-00879

Expressions for droplet breakage and coalescence rates in liquid-liquid dispersions in agitated vessels operating in the laminar or transition range of flow are investigated. Droplet breakage is assumed to be a result of shear on the droplet. Coalescence is assumed to depend on the rate of drop collisions in shear fields, and the coalescence efficiency. The latter is a function of the drainage time for the intervening liquid film between coalescing droplets. Experiments were conducted in an agitated vessel operated batchwise with a disk type turbine impeller. The purpose of the experiments was to study the effects of continuous phase viscosity on the unsteady state behavior, Sauter mean diameter, and the drop size distribution of the dispersion. The systems were (1) kerosene dispersed in aqueous glycerol with continuous phase viscosities mu sub c ranging from 3.6 to 223.1 cP, and (2) mineral oil dispersed in aqueous glycerol with mu sub c ranging from 3.5 to 122.6 cP. Drop size distributions were obtained by photomicrographic methods. Dissert. Abstr.

N78-22319 Washington Univ., St. Louis, Mo.
THE USE OF LASER-HOLOGRAPHY TECHNIQUES FOR STUDYING TWO-PHASE STEAM-WATER CRITICAL FLOW Ph.D. Thesis
Yi-Hsu Ju 1977 131 p
Avail: Univ. Microfilms Order No. 7800936

Laboratory equipment was constructed so that under critical flow conditions the discharging stream could be studied leaving the flow undisturbed. The technique for studying drop size distribution and velocity differences involved the use of in line holography and a Q switched ruby laser as a light source. The three dimensional reconstruction images of steam-water critical flow jet were studied and the results for phase distribution and slip ratios were obtained. Dissert. Abstr.

N78-22320 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE SMALL-SIGNAL RESPONSE OF FLUID TRANSMISSION LINES INCLUDING DEVELOPED MEAN FLOW EFFECTS Ph.D. Thesis
Ernest Frank Moore 1977 188 p
Avail: Univ. Microfilms Order No. 78-04524

Mathematical models of fluid transmission lines of arbitrary cross section were developed to describe the propagation of small signals in developed mean flow. The mean flow may be either laminar or turbulent, and the fluid medium either compressible or incompressible. Expressions for both the frequency and time domain dynamic responses are derived. The analogy between electrical transmission line theory and transient fluid mechanics is used to derive the series impedance, shunt admittance, characteristic impedance, and propagation operator for each distributed parameter model. Author

N78-22321 Purdue Univ., Lafayette, Ind.
ACOUSTIC INTERACTION WITH A TURBULENT PLANE JET Ph.D. Thesis
Frank William Chambers 1977 438 p
Avail: Univ. Microfilms Order No. 78-03206

Effects of a transverse acoustic field upon properties of a turbulent plane jet were investigated. The jet Reynolds number was 6000. Mean pressure profiles were measured to determine the jet widening rate, velocity decay rate, and virtual origins for applied pure tone acoustic frequencies of 200 Hz to 4200 Hz. Turbulent intensities, Reynolds shear stresses, and turbulent energy spectra were measured without an acoustic disturbance, and with disturbance frequencies of 700 Hz and 1600 Hz. Intensities were measured along the jet centerline from X/D = 0 to X/D = 80. Spectra were measured in the jet shear layer and along the centerline from X/D = 0 to X/D = 40. Intensities and shear stresses were measured at X/D = 20, 40, and 60 from Y/B = 0 to Y/B = 2. Assumptions of self-similarity were employed in calculations of the mass flow rates, entrainment rates, Reynolds shear stresses, and shear stress turbulent energy production in the main region of the jet. Dissert. Abstr.

N78-22322 Illinois Univ., Urbana-Champaign.
THE EFFECT OF NATURAL CONVECTION ON HEAT TRANSFER IN CRYOGENIC POROUS INSULATIONS Ph.D. Thesis
Taher Ramadan Dali 1977 121 p
Avail: Univ. Microfilms Order No. 78-03966

An experimental and theoretical study was conducted on two dimensional, steady state, natural convection in gas-filled, cryogenic, porous insulations, packed in a rectangular enclosure with one wall kept at uniform cryogenic temperature with liquid N2 and the other at uniform room temperature. Variation of gas and solid properties, including thermal conductivity, with temperature has a significiant effect on the results and were included in the analysis. The results are presented in terms of dimensionless, temperature distributions, Nusselt numbers, streamlines, and velocity distributions. Good agreement was obtained between the theoretical and experimental results. Dissert. Abstr.

N78-22323 Pennsylvania State Univ., University Park.
THE EVOLUTION OF A SUDDENLY INITIATED, SEMI-CONFINED, TWO-DIMENSIONAL, TURBULENT JET Ph.D. Thesis

Raymond Yaros, Jr. 1977 140 p
Avail: Univ. Microfilms Order No. 78-03381

The starting transient of a fluid amplifier supply jet was investigated. Experiments covered aspect-ratios from 1 to 2 and Reynolds (flow) numbers from 5,000 to 40,000 within 40 nozzle widths of the nozzle exit plane from the period preceding initiation until steady flow was established. Submerged, confined, rectangular, water jets supplied by a gas-pressurized reservoir and initiated by a solenoid-pilot operated valve were recorded with a high speed camera. A mathematical model was formulated for the fluid heat that precedes the starting jet. The experimental results indicate: that the flow number had a minor effect on the starting jets studied, that reducing the aspect-ratio reduced growth of the head diameter as a function of position, and that the supply flow risetime had a significant effect on the speed at which the starting jet moved downstream. Dissert. Abstr.

N78-22324 Texas A&M Univ., College Station.
THE MOMENTUM TRANSFER OF INCOMPRESSIBLE TURBULENT SEPARATED FLOW DUE TO CAVITIES WITH STEPS Ph.D. Thesis
Robert Earl White 1977 262 p
Avail: Univ. Microfilms Order No. 78-06849

An experimental study was conducted using a plate test bed having a turbulent boundary layer to determine the momentum transfer to the faces of step/cavity excrecences on the plate. Tested configurations included an isolated excrecence and an array of blocks in title patterns. A momentum transfer correlation model of pressure forces on an isolated step/cavity was developed with experimental results to relate flow and geometry parameters. Results of the experiments reveal that isolated step/cavity excrecences do not have a unique and unifying parameter group due in part to cavity depth effects and in part to width parameter scale effects. Drag predictions for tile patterns by a kinetic pressure empirical method predict experimental results well.
Dissert. Abstr.

N78-22325 Kentucky Univ., Lexington.
DYNAMIC RESPONSE OF THIN LIQUID LAYER UNDER IMPACT MOTION OF A SOLID PLATE Ph.D. Thesis
Lung-Yen Alun Hwang 1977 183 p
Avail: Univ. Microfilms Order No. 78-06360

The dynamic response of a fluid of small depth induced by a vertical downward impact motion of a horizontal rectangular plate was analyzed. The moving plate was considered to have infinite length in one of its two dimensions. The motion of the plate was time-dependent. The fluid was treated, in different flow models, as incompressible and compressible respectively. The agreement between the experimentally measured pressure-time curves and those obtained from the compressible fluid flow computation reveals that pressure wave transmission and reflection are an integrated part of the flow response and should not be omitted. The solution developed using an incompressible fluid flow model provides good pressure magnitude prediction when the impact motion of the plate is at a slower speed.
Dissert. Abstr.

N78-22326+ Institut National de la Recherche Agronomique, Paris (France). Station de Bioclimatologie.
USE OF DIFFERENT METHODS TO DETERMINE THE SENSITIVE AND LATENT HEAT FLUX UNDER NATURAL CONDITIONS. PART 1: MEASURING THE SURFACE LAYER FLUX AND REGIONAL EVAPOTRANSPIRATION. PART 2: PERFECTION OF A METHOD FOR THE DIRECT MEASUREMENT OF TURBULENT HEAT FLUXES IN THE LOWER ATMOSPHERIC LAYERS Final Report [UTILISATION DE DIFFERENTES METHODES POUR LA DETERMINATION DES FLUX DE CHALEUR SENSIBLE ET LATENTE DANS LES CONDITIONS NATURELLES 1ERE PARTIE: MESURE DES FLUX DE LA COUCHE DE SURFACE ET EVAPOTRANSPIRATION REGIONALE. 2EME PARTIE: MISE AU POINT D'UNE METHODOLOGIE DE MESURE DIRECTE DES FLUX TURBULENT DANS LES ASSES COUCHES ATMOSPHERIQUES]
M. Hallaire, B. Itier, A. Perrier, J. P. Chiapale, and J. Damagnez Dec. 1976 18 p refs In FRENCH
(Contract DGRST-74-7-0479)
Avail: NTIS HC A02

A technique for the measurement of the surface layer heat flux is discussed. The methodology of direct flux measurement by the so-called eddy correlation technique is also discussed. The following instruments were used: hot-wire anemometer and propeller anemometer for velocity fluctuations, hot-wire, thermistance and thermocouple for temperature fluctuations, various types of hygrometers for humidity fluctuations. Some combinations of these instruments were tested in laboratory and in field conditions. Results show that above a height of approximately 10 m, instruments having response-time of about 1 sec can be used: the under-estimation due to the instruments inertia can be evaluated to 10 %, and decreases with height. Near the earth-surface, errors can be very important with such sensors, and it is necessary to employ fast-response sensors, as hot-wire or sonic anemometers, and Ray-Lymen - alpha hygrometer, with their inherent shortcomings (instability, fragility). Author (ESA)

N78-22327*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
AEROTHERMODYNAMIC ASSESSMENT OF CORRUGATED PANEL THERMAL PROTECTION SYSTEMS Final Report
H. J. Brandon, A. H. Britt, H. W. Kipp, and R. V. Masek 31 Jan. 1978 121 p refs
(Contract NAS1-12436)
(NASA-CR-145317) Avail: NTIS HC A06/MF A01 CSCL 20D

The feasibility of using corrugated panels as a thermal protection system for an advanced space transportation vehicle was investigated. The study consisted of two major tasks: development of improved correlations for wind tunnel heat transfer and pressure data to yield design techniques, and application of the design techniques to determine if corrugated panels have application future aerospace vehicles. A single-stage-to-orbit vehicle was used to assess advantages and aerothermodynamic penalties associated with use of such panels. In the correlation task, experimental turbulent heat transfer and pressure data obtained on corrugation roughened surfaces during wind tunnel testing were analyzed and compared with flat plate data. The correlations and data comparisons included the effects of a large range of geometric, inviscid flow, internal boundary layer, and bulk boundary layer parameters in supersonic and hypersonic flow. Author

N78-22328*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PENETRATOR NOZZLE Patent Application
Norris C. Gray, Robert M. Senseny (Boeing Aerospace Co., Seattle), and Phillip N. Bolton, inventors (to NASA) (Boeing Aerospace Co., Seattle) Filed 19 Apr. 1978 10 p
(NASA-Case-KSC-11064-1; US-Patent-Appl-SN-897840) Avail: NTIS HC A02/MF A01 CSCL 20D

A nozzle for use with a fire extinguishing apparatus delivering an extinguishing agent through a barrier surrounding a structure into the interior thereof. The nozzle includes an elongated tubular body which has a pointed penetrating head carried on one end of the tubular body. A source of extingushing agent is coupled to the opposite end of the tubular body and is fed therethrough and passes through and passes through passages adjacent the head for delivering the extinguishing agent to the interior of the structure. A slidable mass is carried on the tubular body on a remote end of the tubular body from the penetrating head. By manipulating the slidable mass and bringing such in contact with an abutment the force imparted to the tubular body causes the head to penetrate the structure. NASA

N78-22329*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL SPATIAL MARCHING TECHNIQUES FOR ESTIMATING DUCT ATTENUATION AND SOURCE PRESSURE PROFILES
K. J. Baumeister 1978 38 p refs Presented at the 95th Meeting of the Acoust. Soc. of Am., Providence, 16-19 May 1978
(NASA-TM-78857; E-9586) Avail: NTIS HC A03/MF A01 CSCL 20D

A numerical method was developed that could predict the pressure distribution of a ducted source from far field pressure inputs. Using an initial value formulation, the two-dimensional

homogeneous Helmholtz wave equation (no steady flow) was solved using explicit marching techniques. The Von Neumann method was used to develop relationships which describe how sound frequency and grid spacing effect numerical stability. At the present time, stability considerations limit the approach to high frequency sound. Sample calculations for both hard and soft wall ducts compare favorably to known boundary value solutions. In addition, assuming that reflections in the duct are small, this initial value approach was successfully used to determine the attenuation of a straight soft wall duct. Compared to conventional finite difference or finite element boundary value approaches, the numerical marching technique is orders of magnitude shorter in computation time and required computer storage and can be easily employed in problems involving high frequency sound. Author

N78-22330*# DCW Industries, Studio City, Calif.
TRANSITIONAL BOUNDARY-LAYER SOLUTIONS USING A MIXING-LENGTH AND A TWO-EQUATION TURBULENCE MODEL
E. Clay Anderson and David C. Wilcox Washington NASA Apr. 1978 50 p refs
(Contract NAS1-14517)
(NASA-CR-2986) Avail: NTIS HC A03/MF A01 CSCL 20D

Boundary-layer solutions were obtained using the conventional two-layer mixing-length turbulence model and the Wilcox-Traci two-equation model of turbulence. Both flatplate and blunt-body geometries were considered. The most significant result of the study is development of approximations for the two-equation model which permit streamwise stepsize comparable to that used in mixing-length computations. Additionally, a set of model-equation boundary conditions derived which apply equally well to both flat-plate and blunt-body geometries. Solutions obtained with the two-equations turbulence model are compared with experimental data and/or corresponding solutions obtained using the mixing-length model. Agreement is satisfactory for flat-plate boundary layers but not for blunt body boundary layers. Author

N78-22331*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WAKE-SHOCK INTERACTION AT A MACH NUMBER OF 6
Michael J. Walsh Mar. 1978 192 p refs
(NASA-TP-1103; L-11904) Avail: NTIS HC A09/MF A01 CSCL 20D

Measurements of mean pitot pressure, static pressure, and total temperature were made in the two dimensional turbulent mixing region of a wake downstream of an interaction with a shock-expansion wave system. The results indicated that: (1) the shock increased the mixing, and (2) the expansion field that followed the shock decreased the turbulent mixing. The overall effect of the shock-expansion wave interaction was dependent on the orientation of the expansion wave with respect to the intersecting shock wave. These data could be used to validate nonequilibrium turbulence modeling and numerical solution of the time averaged Navier-Stokes equations. Author

N78-22332*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLUTION OF AXISYMMETRIC AND TWO-DIMENSIONAL INVISCID FLOW OVER BLUNT BODIES BY THE METHOD OF LINES
H. Harris Hamilton, II Apr. 1978 59 p refs
(NASA-TP-1154; L-11983) Avail: NTIS HC A04/MF A01 CSCL 20D

Comparisons with experimental data and the results of other computational methods demonstrated that very accurate solutions can be obtained by using relatively few lines with the method of lines approach. This method is semidiscrete and has relatively low core storage requirements as compared with fully discrete methods since very little data were stored across the shock layer. This feature is very attractive for three dimensional problems because it enables computer storage requirements to be reduced by approximately an order of magnitude. In the present study it was found that nine lines was a practical upper limit for two dimensional and axisymmetric problems. This condition limits application of the method to smooth body geometries where relatively few lines would be adequate to describe changes in the flow variables around the body. Extension of the method to three dimensions was conceptually straightforward; however, three dimensional applications would also be limited to smooth body geometries although not necessarily to total of nine lines. Author

N78-22333*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF TWO COMPUTER PROGRAMS BY PREDICTING TURBULENT MIXING OF HELIUM IN A DUCTED SUPERSONIC AIRSTREAM
Y. S. Pan, John Philip Drummond, and Charles R. McClinton May 1978 69 p refs
(NASA-TP-1166; L-11949) Avail: NTIS HC A04/MF A01 CSCL 20D

Two parabolic flow computer programs, SHIP (a finite-difference program) and COMOC (a finite-element program), are used for predicting three-dimensional turbulent reacting flow fields in supersonic combustors. The theoretical foundation of the two computer programs are described, and then the programs are applied to a three-dimensional turbulent mixing experiment. The cold (nonreacting) flow experiment was performed to study the mixing of helium jets with a supersonic airstream in a rectangular duct. Surveys of the flow field at an upstream were used as the initial data by programs; surveys at a downstream station provided comparison to assess program accuracy. Both computer programs predicted the experimental results and data trends reasonably well. However, the comparison between the computations from the two programs indicated that SHIP was more accurate in computation and more efficient in both computer storage and computing time than COMOC. Author

N78-22334# Electrotechnical Lab., Tokyo (Japan).
ON THE TRUNCATION ERROR OF A LIMITING FORMULA OF RUNGE-KUTTA METHODS
Hideo Toda Oct. 1977 79 p refs In JAPANESE; ENGLISH summary
(Contract N00014-70-A-0362-0006)
(Rept-772) Avail: NTIS HC A05/MF A01

Fifth order Runge-Kutta methods with five stages can be derived only in the form of limiting formulas. There still remain one or two arbitrary parameters to be determined, which can be used to minimize the truncation error of O(h sup 6). Two types of limiting formulas with fifth order and five stages which can be derived are discussed. A formula for minimizing the truncation errors is proposed and a system for carrying out formal manipulations on mathematical expressions is described, based on experience in using MACSYMA. Author

N78-22335# ARO, Inc., Arnold Air Force Station, Tenn.
THE CALCULATION OF COMPRESSIBLE TRANSITIONAL, TURBULENT, AND RELAMINARIZATIONAL BOUNDARY LAYERS OVER SMOOTH AND ROUGH SURFACES USING AN EXTENDED MIXING-LENGTH HYPOTHESIS Final Report, Jul. 1974 - Sept. 1977
B. K. Hodge and J. C. Adams, Jr. AEDC Feb. 1978 103 p refs
(AD-A050755; ARO-VKF-TR-77-62; AEDC-TR-77-96) Avail: NTIS HC A06/MF A01 CSCL 20/4

Numerical calculations based on the compressible boundary-layer equations and an integral form of the kinetic-energy-of-turbulence (IKET) equation are presented for a variety of conditions. The addition of the IKET equation permits the streamwise computation of an additional dependent variable normally taken as an empirical constant in conventional mixing-length formulations. A baseline turbulence model is developed and then modified to account for the effects of favorable and adverse pressure gradients, roughness, and transpiration. Examples given include adverse and favorable pressure gradients, relaminarization, acoustic-energy-induced transition, surface roughness, and transpiration. The IKET-based extended mixing-length hypothesis is shown to be considerably more flexible than conventional mixing-length turbulence models. Author (GRA)

N78-22336# Oak Ridge Gaseous Diffusion Plant, Tenn. Computing Applications Dept.
CSD-YAQUI: AN EULARIAN COMPUTER CODE FOR FLOW

AT ALL SPEEDS IN DUCTS
J. N. Tunstall Aug. 1977 48 p refs
(Contract W-7405-eng-26)
(K/CSD/TM-9) Avail: NTIS HC A03/MF A01

An IBM 360 computer program designed to solve the Navier-Stokes equations for a viscous, compressible fluid flow in ducts which can be described by quadrilateral cells is presented. A description of the conservative finite differences, the time dependent method of solution, and user details of the FORTRAN program are presented. A sample problem was also reported. ERA

N78-22337# California Univ., Livermore. Lawrence Livermore Lab.
FLOW OBSERVATION BY ROD LENS AND LOW-LIGHT VIDEO, VIDEOTAPE SCRIPT: 4 JANUARY 1977
D. E. Lord, G. W. Carter, and R. R. Petrini 10 Aug. 1977 19 p
(Contract W-7405-eng-48)
(UCRL-52324) Avail: NTIS HC A02/MF A01

The script of a demonstration videotape made to show the possibilities of coupling rod lenses to low light video systems to observe internal flow conditions is presented. The illustration accompanying the text were photographed directly from the video screen. A description of the multiscan low light television system developed to measure velocity is included in the epilogue. ERA

N78-22338# Unilever Research, Vlaardingen (Netherlands).
EFFECTS OF INTERFACIAL FORCES ON THE EVAPORATION OF A SUPERHEATED WATER DROPLET IN HOT IMMISCIBLE OIL
F. C. H. Jongenelen, F. Groeneweg, and J. H. Gouda [1977] 21 p refs Revised Submitted for publication
Avail: NTIS HC A02/MF A01

The release of vapor bubbles from the surface of a superheated water droplet submerged in a hot immiscible oil was studied. Theoretical calculations indicate that the maximum bubble size and the residence time of the vapor bubble at the oil/water interface are controlled by the difference between the surface tensions at the oil/vapor and water/vapor interfaces. The interfacial forces act on the vapor bubble as a net force directed towards the oil phase. If the difference between the interfacial forces is substantial, the formation of strings if vapor bubbles can be predicted. When this difference is lowered by adding surfactant to the system, the bubble size and its residence time at the oil/water interface increase; this was confirmed by experiment. In the absence of a surfactant, there is a big difference between the respective surface tensions and, as a result, a string of tiny (0.2 mm) vapor bubbles is released from the oil/water interface for 1 to 2 min until the water droplet evaporates explosively, giving rise to the formation of a very large (40 mm) vapor bubble. In the presence of a surfactant (low difference between surface tensions) the medium size (5 mm) vapor bubble elongates the water droplet, finally causing timely fragmentation of the droplet. Author (ESA)

N78-22339# Research Inst. of National Defence, Stockholm (Sweden).
APPROXIMATE THEORY ON THE CAVITY FORMATION ON PROJECTILE IMPACT IN DENSE MEDIA
Bo Janzon Aug. 1977 15 p refs
(FOA-C-20196-D4) Avail: NTIS HC A02/MF A01

The flow and behavior of a medium of comparatively low strength impacted by a fast projectile was investigated using the theory of steady state and pseudo steady-state conditions. Simple hydrodynamic calculations on fully cavitating projectiles traversing dense media resulted in three formulas describing cavity formation on: (1) penetration in a semi-infinite medium without material strength; (2) steady-state penetration in a finite medium without material strength; and (3) steady-state penetration in a finite medium with material strength. The formulas are not time-dependent and describe the maximum size of the temporary cavity. Author (ESA)

N78-22340# Institut Franco-Allemand de Recherches, St. Louis (France).
DETECTION OF LARGE SCALE COHERENT STRUCTURES IN FREE JETS BY LASER ANEMOMETRY AND CROSSED BEAM SCHLIEREN TECHNIQUES
Bernhard Koch and Hans J. Pfeifer 29 Jul. 1977 11 p refs Presented at the 5th Bien. Symp. on Turbulence, Rolla, Mo., 3-5 Oct. 1977
(ISL-CO-210/77) Avail: NTIS HC A02/MF A01

Novel methods developed in the field of optical configurations, signal acquisition devices, and data processing systems made it possible to measure correlations in free jets using both laser Doppler anemometry and crossed beam schlieren techniques. These measurements led to information on the power spectral density of velocity fluctuations and fluctuations in the gas density gradients. It was possible to demonstrate the presence of large-scaled coherent structures in the potential core of the free jet and to measure the convection velocity with which those structures are moving. Author (ESA)

N78-22341# Institut Franco-Allemand de Recherches, St. Louis (France).
FLOW CALCULATION IN THE HIGH POWER LASER WIND TUNNEL: CASE OF A DISCHARGE IN A PURE SUPERSONIC FLOW [CALCUL DE L'ECOULEMENT DANS LA SOUFFLERIE DU LASER DE PUISSANCE: CAS D'UNE DECHARGE EN ECOULEMENT ENTIEREMENT SUPERSONIQUE]
P. C. Jaeggy and G. Jaeggy 18 Jan. 1977 147 p refs In FRENCH
(Contract DRME-74/397)
(ISL-R-101/77) Avail: NTIS HC A07/MF A01

The flow in the ISL high power CO2 laser wind tunnel was investigated taking into consideration phenomena related to the excitation and vibration relaxation of the gas. The calculation was based on a theoretical model leading to a first order differential equation system of classical form which is solved by using the Runge-Kutta method. A detailed description is presented of the FORTRAN 4 computer program written for an IBM 370/135. ESA

N78-22342# Institut Franco-Allemand de Recherches, St. Louis (France).
GENERATION OF VIBRATIONAL ENERGY BY INDEPENDENT ELECTRIC DISCHARGE IN A SUPERSONIC CO2 LASER GAS MIXTURE: SUMMARY OF RESULTS AT ISL. INFLUENCE OF HOMOGENEITY OF THE ELECTRIC DISCHARGE ON THE ENERGY CONVERSION EFFICIENCY (EFFECTS OF TURBULENCE, MICROWAVE PREIONIZATION) Final Report [CREATION D'ENERGIE VIBRATIONNELLE PAR DECHARGE ELECTRIQUE AUTONOME DANS UN MELANGE GAZEUX LASER CO2 EN ECOULEMENT SUPERSONIQUE: SYNTHESE DES RESULTATS ACQUIS PAR L'ISL. INFLUENCE DE L'HOMOGENEITE DE LA DECHARGE ELECTRIQUE SUR LE RENDEMENT DE CONVERSION ENERGETIQUE (EFFETS DE LA TURBULENCE, PREIONISATION HYPERFREQUENCE)]
R. Joeckle and G. Stern 11 Jul. 1977 24 p refs In FRENCH
(Contract DRME-74/397)
(ISL-R-111/77) Avail: NTIS HC A02/MF A01

The possibility of realizing a high power CO2 laser using an independent electric discharge to generate molecular vibrations in a supersonic CO2 laser gas mixture was investigated. The supersonic flow is produced by air blasts from a wind tunnel nozzle allowing Mach numbers of 2 to be attained. Several tests showed that this excitation method is limited by thermal instabilities as from a power density of 1 to 2 W/cu cm. This threshold is pressure-independent and largely affected by the homogeneity of the discharge plasma. Two methods were examined for increasing plasma homogeneity, one based on turbulence effects and the other on microwave preionization. With the first method a power density of 9 W/cu cm was obtained with a volume of 1400 cu cm and a specific energy of 450 J/g. Conversion efficiency was 50 %. The second method led to a homogeneous discharge of 20 W/cu cm with a volume of 350 cu cm and specific energy of 300 J/g. ESA

N78-22343# Institut Franco-Allemand de Recherches, St. Louis (France).
NUMERICAL STUDY OF THE EVOLUTION OF A ONE DIMENSIONAL FLUCTUATION IN A COMPRESSIBLE FLOW

LIMITED BY A NOZZLE [ETUDE NUMERIQUE DE L'EVOLUTION D'UNE FLUCTUATION MONODIMENSIONNELLE DANS UN ECOULEMENT COMPRESSIBLE LIMITE PAR UNE TUYERE]

G. Jaeggy 9 Dec. 1976 67 p refs In FRENCH
(ISL-R-135/76) Avail: NTIS HC A04/MF A01

An unsteady numerical method of finite difference for calculating a quasi-one-dimensional compressible perturbed flow was investigated theoretically. The method was used to investigate pressure, density, or temperature fluctuations in the outlet flow of a nozzle. A doubling of the perturbation was observed in some cases for which a part of the flow propagates as an acoustic wave, while the other part follows the flow. The FORTRAN program for the calculation is presented. ESA

N78-22344# European Space Agency, Paris (France).
INVESTIGATION ON THE DISTRIBUTION OF THE LIQUID IN AN EVAPORATING JET INJECTED PERPENDICULARLY TO AN AIR FLOW

W. Buschulte Feb. 1978 28 p refs Transl. into ENGLISH of 'Untersuch. ueber die Verteilung der Fluessigkeit eines zerstaeubenden, senkrecht in einen Luftstrom eingespritzten Fluessigkeitsstrahls', DFVLR, Trauen, West Ger. Report DLR-IB-456-77/1, 1977 Original report in GERMAN previously announced as N78-15454
(ESA-TT-449; DLR-IB-456-77/1) Avail: NTIS HC A03/MF A01

The liquid distribution characteristics of an injection system in which the liquid jet is perpendicular to the air flow were determined. The results are in agreement with those published by others. The order of magnitude of the mixing ratios in the injection field can be determined in an easy way. The tests were made with water jets. ESA

N78-22603# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
INFRARED EMITTANCE OF ELECTROMAGNETIC PHANTOM MATERIALS AND INFRARED TRANSMITTANCE OF POLYETHYLENE

T. C. Cetas (Arizona Univ., Tucson) and G. Kantor *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 152-169 refs (For availability see N78-22591 13-51)
(Contract FD-03189-76-J; Grant CA-17343-01)
Avail: NTIS MF A01; SOD HC

N78-23026*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF FLUIDICS TO NEW CONTROL COMPONENTS

Miles O. Dustin, Vernon D. Gebben, and Robert E. Wallhagen *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 365-386 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-22345*# Geological Survey, Washington, D. C.
CALCULATION OF EVAPOTRANSPIRATION USING COLOR-INFRARED PHOTOGRAPHY

John Edwin Jones 1977 40 p refs Sponsored by NASA
(NASA-CR-156157; GSPP-655-0) Avail: NTIS MF A01; SOD HC CSCL 14E

Data from 38 color-infrared photographic missions flown during a five year period over the Gila River Phreatophyte Project in southeastern Arizona were analyzed to determine the possibility of identifying and measuring vegetative parameters and their associated hydrologic variables by spectral analysis of the photographs. The derived spectra equations are discussed, and a table of 24 statistical parameters describing the spectral and hydrologic variables is included. Author

N78-22346*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FATIGUE FAILURE LOAD INDICATOR Patent Application

Leland A. Imig, William T. Davis, and David C. Davis, inventors (to NASA) Filed 24 Mar. 1978 11 p
(NASA-Case-LAR-12027-1; US-Patent-Appl-SN-889670) Avail: NTIS HC A02/MF A01 CSCL 14B

A device for measuring the load on a fatigue test specimen at the instant the specimen breaks is reported. The invention consists essentially of a conventional fatigue testing machine connected to a fatigue failure load indicator. Alternate tension and compression dc load signals were applied to a summing amplifier by means of an input load signal device. These signals caused a hydraulic cylinder to alternately apply tension and compression loads to the specimen. A load cell was attached to the specimen to produce dc voltage proportional to the load on the specimen. This signal was amplified to subtract from the load signals from the input load signal device. A peak detector has its measuring input connected through a closed contact of relays to the output of the amplifier and has its reset input connected through another closed contact of relays to the output of the summing amplifier. NASA

N78-22347*# National Aeronautics and Space Administration. Pasadena Office, Calif.
REDUNDANT OPERATION OF COUNTER MODULES Patent Application

Satoshi Nagano, inventor (to NASA) (JPL) Filed 4 Apr. 1978 20 p
(Contract NAS7-100)
(NASA-Case-NPO-14162-1; NASA-Case-NPO-14167-1; NASA-Case-NPO-14169-1; US-Patent-Appl-SN-893903) Avail: NTIS HC A02/MF A01 CSCL 14B

Redundant operation of counter modules is maintained by detecting the zero state of each counter and clearing the other to that state, thus periodically resynchronizing the counters, and obtaining an output from both counters through ac coupled diode-OR gates. Redundant operation of counter flip-flops is maintained in a similar manner, and synchronous operation of redundant squarewave clock generators of the feedback type is effected by connecting together the feedback inputs of the squarewave generators through a coupling resistor, and obtaining an output from both generators through ac coupled diode-OR gates. NASA

N78-22348*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR FORMING A QUADRIFID IMAGE COMPRISING ANGULARLY RELATED FIELDS OF VIEW OF A THREE DIMENSIONAL OBJECT Patent Application

Frederick R. Chamberlain, inventor (to NASA) (JPL) Filed 20 Mar. 1978 13 p
(Contract NAS7-100)
(NASA-Case-NPO-14219-1; US-Patent-Appl-SN-888432) Avail: NTIS HC A02/MF A01 CSCL 14E

A system is presented for forming a composite image to be photographed and more particularly to an improved system for forming a quadrifid composite image consisting of separate images of a plurality of angularly related fields of view of a three dimensional object. The present invention is embodied in a system which includes a first, second and third subsystem, and each of which includes a combination of reflecting surfaces adapted to reflect images of orthogonally related fields of view to provide a quadrifid image for a camera. The camera lens, in turn, focuses the quadrifid image on a film frame, in the film plane for photographically recording the quadrifid image. By employing the system of the instant invention, a simultaneous photographing of the images of orthogonally related fields of view is facilitated. NASA

N78-22349# Royal Aircraft Establishment, Farnborough (England).
THE MAXIMUM SENSITIVITY OF WHEATSTONE BRIDGES

OPERATING ON ALTERNATING CURRENT
A. Th. Popesco Nov. 1977 37 p refs Transl. into ENGLISH from Rev. Gen. de l'Elec. (France), v. 74, no. 4, 1965 p 305-315
(RAE-Lib-Trans-1955; BR62234) Avail: NTIS HC A03/MF A01

A method of graphical calculation is presented which makes possible the exact determination of the minimum value of a function of complex variables of the type used by Lord Rayleigh. A numerical example illustrates these theoretical considerations and demonstrates their accuracy. Author

N78-22350# Sandia Labs., Albuquerque, N. Mex. Field Instrumentation Div.
SLIFER DECIPHER
Dale R. Breding, Gordon S. Worthen, Joan J. Loukota, Don Fogel, and John P. Watterberg Oct. 1977 70 p
(Contract EY-76-C-04-0789)
(SAND-77-0931) Avail: NTIS HC A04/MF A01

The SLIFER Decipher (SD) is a digital instrument that records a time-varying frequency signal in the range from 700 kHz to 1500 kHz with an amplitude greater than 200 mV. This signal is referenced to an input fiducial marker. The primary purpose of this instrument is to reduce data recorded on magnetic tape from the SLIFER system used in underground nuclear tests. The SD records 512 samples after the fiducial signal, with a sample interval of 50 micro sec (for a total recording time of 25.55 ms). The measurement essentially uses a 20-cycle period-averaging counter technique. ERA

N78-22351# National Bureau of Standards, Washington, D. C. Electronic Technology Div.
EXPERIMENTAL INVESTIGATION OF MEANS FOR REDUCING THE RESPONSE OF PRESSURE TRANSDUCERS TO THERMAL TRANSIENTS Final Report
John S. Hilten, C. F. Vezzetti, J. F. Mayo-Wells, and P. S. Lederer Jan. 1978 66 p refs Sponsored by Naval Air Systems Command and Sandia laboratories
(PB-275452/1; NBS-TN-961) Avail: NTIS HC A04/MF A01 CSCL 14B

The effects of a variety of protective coatings on the amount and rate of thermal energy transmission through thin metal disks were investigated, as revealed by measurements of the disk backside temperature. The temperature histories of both bare and protected disks were measured with thermocouples during and after exposure of the disks to thermal radiant-energy transients. Protective coatings investigated include various tapes, greases, and room-temperature-vulcanizing rubbers. Author

N78-22352# Rochester Univ., N. Y. Dept. of Radiation Biology and Biophysics.
TIME-OF-FLIGHT AEROSOL BEAM SPECTROMETER FOR PARTICLE SIZE MEASUREMENTS Final Report, Jun. 1974 - Mar. 1977
Barton Dahneke Nov. 1977 94 p refs
(Grant EPA-R-803065)
(PB-276644/2; EPA-600/2-77-229) Avail: NTIS HC A05/MF A01 CSCL 14B

The instrument was designed and constructed to perform in situ real time measurements of the aerodynamic size of individual aerosol particles in the range 0.3 to 10 micrometers diameter. The measurement method consists of: (1) allowing a sample aerosol to undergo expansion through a nozzle into a vacuum chamber, such that each particle acquires a terminal velocity depending on its aerodynamic size, the (2) measuring the terminal velocity by determining the time taken for each particle to traverse a laser beam of fixed width. Author

N78-22353*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING LANDER CAMERA RADIOMETRY CALIBRATION REPORT, VOLUME 2
Michael R. Wolf, David L. Atwood, and Michael E. Morrill 1 Nov. 1977 920 p refs
(Contract NAS7-100)
(JPL-Pub-77-62-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 14E

The requirements the performance validation, and interfaces for the RADCAM program, to convert Viking lander camera image data to radiometric units were established. A proposed algorithm is described, and an appendix summarizing the planned reduction of camera test data was included. Author

N78-22251 Joint Publications Research Service, Arlington, Va.
LASER VIBRATORY GYROSCOPE
A. A. Golovan and A. V. Salmin *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 30-35 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Priborostr. (Leningrad), no. 1, 1978 p 58-62 (For availability see N78-22249 13-31)
Copyright. Avail: Issuing Activity

N78-22252 Joint Publications Research Service, Arlington, Va.
THE USE OF STRUCTURAL REDUNDANCY TO INCREASE THE ACCURACY OF MEASUREMENT OF ABSOLUTE ANGULAR VELOCITY
M. S. Davydov and A. A. Potapov *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 36-40 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn, Zavedenii Priborostr. (Leningrad), no. 11, 1977 p 74-77 (For availability see N78-22249 13-31)
Copyright. Avail: Issuing Activity

N78-22253 Joint Publications Research Service, Arlington, Va.
A GENERAL ALGORITHM FOR AN ANALYTIC METHOD OF GYROCOMPASSING
V. V. Seregin *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 41-47 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Priborostr. (Leningrad), no. 11, 1977 p 77-83 (For availability see N78-22249 13-31)
Copyright. Avail: Issuing Activity

N78-22254 Joint Publications Research Service, Arlington, Va.
THE MUTUAL ORIENTATION OF TWO THREE-AXIS GYROSTABILIZED PLATFORMS FOR SYSTEMS WITH INDEPENDENT ERROR DETECTION
V. L. Frolov *In its* Transl. on USSR Sci. and Technol. (JPRS-71006) 25 Apr. 1978 p 48-53 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Priborostr. (Leningrad), no. 11, 1977 p 83-88 (For availability see N78-22249 13-31)
Copyright. Avail: Issuing Activity

N78-22602# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
INTERNAL DOSIMETRY AND EXTERNAL MICROWAVE FIELD MEASUREMENTS USING MINIATURE ELECTRIC FIELD PROBES
Howard Bassen *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 136-151 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-22354 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
INVESTIGATION OF DIATOMIC CESIUM AS A LASER MEDIUM BY ABSORPTION AND FLUORESCENCE SPECTROSCOPY Ph.D. Thesis
Rettig Palmer Benedict, Jr. 1977 179 p
Avail: Univ. Microfilms Order No. 78-02776

The potential of Cs2 as a candidate for a high efficiency laser was examined using absorption and fluorescence spectroscopy. The absorption spectra of the Cs2 molecule was measured over the wavelength range of 0.8 - 1.3 microns. The fluorescence of Cs2 was observed for temperature between 225 C and 360 C with a xenon buffer gas. The spectra were normalized to the atomic line emission via the CsXe red wing of the 0.894 micron line of Cs. The normalized emission was used to calculate the stimulated emission coefficient per excited Cs atom. On the basis of these experiments, gain could possibly be achieved for a 15% atomic inversion. The variations of the integrated normalized

emission spectra with xenon density were used to quantify the important kinetic rate constants. Dissert. Abstr.

N78-22355 Illinois Univ., Urbana-Champaign.
NEAR INFRARED INDIUM GALLIUM PHOSPHIDE ARSENIDE DOUBLE HETEROJUNCTION LASERS Ph.D. Thesis
Phillip Douglas Wright 1977 126 p
Avail: Univ. Microfilms Order No. 78-04200

Laser emission spectra at 77 K, 197 K, and 300 K are presented. The oberservation of Fabry-Perot cavity modes in the low level spontaneous emission spectra permits the determination of the effective index of refraction over a wide wavelength range. Index dispersion data are presented showing that the effective index of refraction of a semiconductor laser is not a single curve but is instead a family of curves that depend upon injection level. Finally, laser operation of near infrared Indium Gallium Phosphide Arsenide double heterojunctions in a wavelength selective external cavity is reported. Diode laser operation in a wavelength selective external cavity permits tunable, narrow linewidth laser emission, and was used to clarify the nature of line broadening in a semiconductor laser. Dissert. Abstr.

N78-22356 Materials Research Labs., Melbourne (Australia).
A VIBRATING MIRROR SYSTEM SUITABLE FOR Q-SWITCHING LARGE-APERTURE LASERS
P. J. Beckwith Nov. 1977 19 p refs
(MRL-R-700; AR-000-873) Copyright. Avail: Issuing Activity

Resonant vibrating mirrors provide a convenient means of Q-switching a laser, but large-aperture versions require careful design if the drive power is not to become excessive. This report outlines the design principles involved in the optimization of moving-iron galvanometer drivers, and describes a prototype device with an aperture of 40 mm x 80 mm which is capable of beam deflections of plus or minus 40 mrad at 800 Hz. Some suggestions are made concerning more refined designs. Author

N78-22357+ Societe de Production et de Recherches Appliquees, La Garenne-Colombes (France).
FREQUENCY STABILIZATION OF A HIGH RESOLUTION LASER IMPULSE SPECTROMETER Final Report [STABILISATION DE LA FREQUENCE D'UN SPECTROMETRE LASER IMPULSIONNEL DE HAUTE RESOLUTION]
Jean-Louis Stehle 26 Oct. 1976 11 p In FRENCH
(Contract DGRST-75-710-50)
Avail: NTIS HC A02

The frequency stabilization of a dye laser spectrometer pumped by a nitrogen laser was studied. A mounting was implemented with which the inclination of the intracavity sample can be changed around two perpendicular axes by means of two micrometer screws placed outside the sample area. This setup enables a very fine sweep control of the Fabry-Perot. Experience has shown that the mechanical stability of the system is excellent. ESA

N78-22358+ Ecole Polytechnique, Paris (France). Lab. de Physique des Milieux Ionises.
HIGH POWER INFRARED MASER AND LASER Final Report
Henri Jean Doucet Dec. 1976 13 p In FRENCH
(Contract DGRST-75-7-0121)
Avail: NTIS HC A02

A synchrotron maser operating in the X band using a beam of relativistic electrons coupled with a waveguide was developed. The magnetic pumping was studied and implemented by a non-adiabetic movement of the electrons in a rapidly variable magnetic field. The principle of the conversion of the frequency of centimeter waves to infrared was studied theoretically and experimentally using the relativistic Doppler effect on a front of the electron beam. The conversion of waves from the X band to the K band was observed. ESA

N78-22359*# National Aeronautics and Space Administration. Pasadena Office, Calif.
DIELECTRIC-LOADED WAVEGUIDE CIRCULATOR FOR CRYOGENICALLY COOLED AND CASCADED MASER WAVEGUIDE STRUCTURES Patent Application
Robert C. Clauss (JPL) and Rex B. Quinn, inventors (to NASA) (JPL) Filed 9 Feb. 1978 13 p
(Contract NAS7-100)
(NASA-Case-NPO-14254-1; US-Patent-Appl-SN-876432) Avail: NTIS HC A02/MF A01 CSCL 20E

An assembly of four cascaded reflected-wave masers embodied in a structure are schematically illustrated. Each maser is connected to another maser by a dielectrically loaded four-port waveguide circulator. The first and third ports are connected waveguides loaded with dielectric material, for example magnesium titanate having a dielectric constant equal to 13 in 1/4 inch wide waveguides for a signal at 0 GHz. The second port is connected to a reflected-wave maser by a matching transformer comprised of two rectangular pieces of dielectric material with a sheet of conductive material, such as indium, pressed between them. This transformer couples signal energy between the circulator and the maser, and blocks pumping energy from a source distributed to the masers by a chamber through filters each comprised of a waveguide filled with an alumina rod. The fourth port of each circulator is connected to a waveguide filled with microwave energy absorbing material. NASA

N78-22360# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
ENERGY TRANSFER IN A2 SIGMA OH. 1: ROTATIONAL
Russell K. Lengel and David R. Crosley Jan. 1978 55 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A051051; ARBRL-TR-02035) Avail: NTIS HC A04/MF A01 CSCL 07/4

A frequency doubled, tunable dye laser was used to excite individual V, N, J levels of the A- state of the OH molecule. The fluorescence emitted in the presence of known pressures of various fill gases permitted the determination of collisionally induced population changes, and state-to-state energy transfer rates. Results are presented on rotational energy transfer within v=0, using six different initially pumped levels for nitrogen as a collision partner, and two each for hydrogen and argon. It was found that the rates were fast, that a process having delta N = delta J occurs faster than one where delta N does not equal delta J, and that multiquantum transfer rates were nearly as large as single quantum transfer rates. Author

N78-22361# Avco-Everett Research Lab., Everett, Mass.
EXCIMER LASER RESEARCH Semiannual Report, 16 Mar. - 15 Sep. 1977
J. H. Parks 1977 34 p refs
(Contract N00014-75-C-0063; ARPA Order 1806)
(AD-A050591) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report describes experimental and theoretical investigations of the mercury monohalides. As a class, these molecules show great promise for achieving high power scalable laser action in the visible portion of the spectrum. Author (GRA)

N78-22362# Ampex Corp., Redwood City, Calif.
VIDEO LASER BEAM RECORDER Final Report, May 1973 - Sep. 1976
Lawrence Teeple Apr. 1977 162 p refs
(Contract F33615-73-C-1152)
(AD-A050615; RR-76-10; AFAL-TR-76-269) Avail: NTIS HC A08/MF A01 CSCL 17/2

This contract continues work accomplished on Contract F33615-73-C-1213 and F33615-71-C-1371 to develop a high performance airborne dual channel 16 mm laser beam film recorder for television type sensors. Two channels of interlaced video pictures in 525 or 875 lines per frame format are recorded on film at 30 frames per second, with frames in Super 8mm format side by side on 2-1/2 mil high resolution 16/mm film with variable density optical sound track for each channel. The physical system, packaged in an airborne unit 12.75 in. x 32.75 in. x 29 in., consists of a helium-neon laser as a radiation source, acousto-optic modulators as electro-optic transducers, catadioptric flat field linear scan optics, ball bearing suspended 16-face rotating mirror polygon as horizontal scanner, galvanometer deflector as vertical scanner, and a rolling loop mechanism transport as film camera. The laser optics and control system attain 70% transfer efficiency at 16 MHz bandwidth. The rolling loop transport does not allow full realization of the performance of the laser optics and control system. Recommendations include sacrifice of frame

height for film stability and de-interlace of video signals for film recording. Author (GRA)

N78-22363# Ohio State Univ., Columbus. Electroscience Lab.

THEORETICAL STUDY OF THE TURBULENCE INDUCED SCINTILLATION OF A DIRTY LASER BEAM Interim Report, Jan. - Sep. 1977

D. D. Duncan Griffiss AFB, N. Y. RADC Jan. 1978 179 p refs

(Contract F30602-76-C-0058; AF Proj. 1279)

(AD-A050874; ESL-4232-5; RADC-TR-77-430) Avail: NTIS HC A09/MF A01 CSCL 20/5

This work is concerned with predicting the temporal scintillation spectrum of a laser beam which has propagated through the turbulent atmosphere. Use is made of the Extended Huygens-Fresnel principle in deriving a very general but compact mathematical expression for the temporal scintillation spectrum of an unspecified source field with an arbitrary shaped extended receiver aperture. This formula, which is restricted to the weak turbulence regime, is then applied to the analysis of several situations of contemporary interest. Specifically, the analysis is directed toward the description of the effects of such a laser beam which is blemished in a deterministic sense. Spectra obtained under these conditions are shown to display increased sensitivity to the path distribution of the turbulence strength. GRA

N78-22364# Avco-Everett Research Lab., Everett, Mass.

INVESTIGATION OF LASER PROPULSION, VOLUME 1 Final Technical Report, 1 Mar. 1976 - 15 Nov. 1977

P. K. Chapman, D. H. Douglas-Hamilton, and D. A. Reilly Nov. 1977 144 p refs

(Contract N00014-76-C-0646; DARPA Order 3138)

(AD-A050506) Avail: NTIS HC A07/MF A01 CSCL 21/8

The use of large ground based lasers to radiate power into a rocket engine allows arbitrary choice of propellant and specific impulse. The case of launch of one ton payload from near ground to geosynchronous transfer ellipse appears to be feasible using stacked carbon dioxide repetitive pulse lasers. Atmospheric propagation is enhanced by bleaching out CO2 absorption and using phase correction of the thermal blooming generated, 1 microradian beam spreading can be achieved. The use of pulsed lasers permits an engine based on the laser detonation wave, in which laser energy is efficiently absorbed by inverse Bremsstrahlung in the propellant, which then expands out of the engine and provides thrust. GRA

N78-22365# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.

NOVEL CHEMICAL LASER SYSTEMS Final Report, 15 Jun. 1974 - 31 Mar. 1977

Terrill A. Cool Nov. 1977 40 p refs

(Grant AF-AFOSR-2550-73; AF Proj. 2303)

(AD-A050579; AFOSR-78-0156TR) Avail: NTIS HC A03/MF A01 CSCL 20/5

Chemiluminescence spectra were recorded for a variety of metal-oxidizer reactions and measurements of fluorescence rates were performed for molecular bonds and atomic emissions. Dissociation reactions to produce large concentrations of metal atoms on a short time scale were carried out by means of thermal, electrical and electron beams procedures. Nearly all systems studied had low fluorescence rates for product metal oxide or metal halide molecules. Laser action was observed for over 40 new wavelengths from 17 metal atoms formed from the dissociation of metal halides, hydrides, alkyls and carbonyls. These wavelengths were in the near IR from 1.152 to 14.54 microns and were identified with transitions in the atoms: As, Bi, Cd, Fe, Ga, Ge, Hg, In, Ni, Pb, Se, Sn, Te, Tl, V and Zn. Electronically excited YCl was formed from the reaction of chlorine with Y metal; chemiluminescent spectra from the excited YCl species were recorded in a shock tube-driven supersonic mixing flame. Strong emission was noted near 4000Z and weaker bands at longer wavelengths believed to arise from triplet states of chemically formed YCl. This reaction system is of interest because of a high photon yield, a high degree of specificity in energy disposal among product states and the possible existence of laser transitions of appropriate radiative lifetimes for chemical laser operation. GRA

N78-22366# California Univ., Livermore. Lawrence Livermore Lab.

CONSTRUCTION OF A LARGE LASER FUSION SYSTEM

C. A. Hurley 1977 6 p refs Presented at the 7th IEEE Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977

(Contract W-7405-eng-48)

(UCRL-79677; Conf-771029-56) Avail: NTIS HC A02/MF A01

Construction of a large laser fusion machine is nearing completion at the Lawrence Livermore Laboratory (LLL). Shiva, a 20 terawatt neodymium doped glass system, will be complete in early 1978. This system will have the high power needed to demonstrate significant thermonuclear burn. Shiva will irradiate a microscopic DT pellet with 20 separate laser beams arriving simultaneously at the target. This requires precise alignment, and stability to maintain alignment. Hardware for the 20 laser chains is composed of 140 amplifiers, 100 spatial filters, 80 isolation stages, 40 large turning mirrors, and a front-end splitter system of over 100 parts. These are mounted on a high stability, three dimensional spaceframe which serves as an optical bench. The mechanical design effoer, spanning approximately 3 years, followed a classic engineering evolution. The conceptual design phase led directly to system optimization through cost and technical tradeoffs. ERA

N78-22367# California Univ., Livermore. Lawrence Livermore Lab.

COMPARISON OF THEORY AND SIMULATIONS WITH RECENT LASER PLASMA EXPERIMENTS

Claire Ellen Max 17 Oct. 1977 63 p refs Presented at the Ann. Am. Phys. Soc. Meeting, Atlanta, 7-11 Nov. 1977

(Contract W-7405-eng-48)

(UCRL-79859; Conf-771136-6) Avail: NTIS HC A04/MF A01

A quantitative comparison of the data with current results of plasma simulations and theory is presented and the areas where further theoretical effort is called for are pointed out. Experiments are compared with and simulation results on laser plasma interactions. The analysis covers the following areas: (1) theory of resonance absorption on a rippled critical surface, compared with an experiment on the angle and polarization dependence of absorption; (2) theory of density profile steepening, compared with holographic interferometry measurements; and (3) theory of stimulated Brillouin scattering in long density gradients, compared with reflectivity measurements for long pulse, large focal spot experiments. ERA

N78-22368# Institut Franco-Allemand de Recherches, St. Louis (France).

LASER INTERFERENCE VELOCIMETER FOR HIGH TIME RESOLVING INSTANTANEOUS REGISTRATIONS

G. Smeets 17 May 1977 12 p refs Presented at the 7th Intern. Congr. on Instr. in Aerospace Simulation Facilities (ICIASF), Shrivenham, Engl., 6-8 Sep. 1977

(ISL-CO-208/77) Avail: NTIS HC A02/MF A01

A new species of a laser Doppler velocimeter, based on a wavelength detection by means of a two beam interferometer, is presented. A couple of testing experiments are described demonstrating the performance of the system. The technique supplies a real time velocity signal and can, in principle, attain a time resolution of a microsecond or lower. A wide field of possible future applications is supposed. Author (ESA)

N78-22422 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

AN INVESTIGATION OF THE ZERO-POINT STABILITY OF THE PRESENT WETTZELL LASER RANGING SYSTEM

Klemens Nottarp *In its* Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 67-69 refs (For availability see N78-22415 13-42)

Avail: NTIS HC A04/MF A01

N78-22735# Joint Publications Research Service, Arlington, Va.
INTERKOSMOS LASER SATELLITE RANGEFINDER
V. A. Yegorov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., no. 29 (JPRS-70659) 21 Feb. 1978 p 76-77 Transl. into ENGLISH from Priroda (USSR), no. 10, 1977 p 143 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-22369 Rensselaer Polytechnic Inst., Troy, N. Y.
OPTIMUM DESIGN OF SHELL STRUCTURES SUBJECT TO CONSTRAINTS Ph.D. Thesis
Robert Allen Rand 1977 344 p
Avail: Univ. Microfilms Order No. 78-02860

Techniques were developed for the automated optimum design of general composite shells subject to frequency and/or stress constraints. The optimum design problem was posed as a general mathematical programming problem with only inequality constraints. Calculation of the constrained frequency was performed by discretizing the shell using a finite element technique and then minimizing a special Rayleigh quotient defined for the discrete model. A quadrilateral shell element was developed to discretize the shell. The stiffness matrix for the element was derived using the smooth surface interpolation functions of Pian and is suitable for the analysis of anisotropic shells of arbitrary shape. The mass matrix for the element was a hybrid which incorporates the computational advantages of a lumped mass matrix with the accuracy of a consistent mass matrix. Dissert. Abstr.

N78-22370 California Univ., Davis.
THERMAL AND DYNAMIC EFFECTS IN ELECTRON BEAM WELDING CAVITIES Ph.D. Thesis
Dale Albert Schauer 1977 173 p
Avail: Univ. Microfilms Order No. 78-03636

An experimental and analytical study of the temperature distributions along the molten metal surface in an electron beam welding cavity was performed. An analysis for predicting cavity oscillation frequency shows reasonable agreement with frequencies measured at the weld root determined from weld sections. A study of the measured temperature distributions in cavities of varying depth combined with the force imbalance observations led to an interpretation of when spiking might occur. A procedure was proposed for determining the spiking tendency for a given set of weld parameters. The results permit a designer to select apriori the best set of weld parameters to achieve a weld of predictable quality. Dissert. Abstr.

N78-22371 Maryland Univ., College Park.
INTERACTION OF COMBUSTION WITH THE AERODYNAMIC FLOWFIELD IN AN INTERNAL COMBUSTION RECIPROCATING ENGINE: A TWO-DIMENSIONAL NUMERICAL SOLUTION Ph.D. Thesis
Ramachandra Diwakar 1977 131 p
Avail: Univ. Microfilms Order No. 7805023

The flowfield between the top of the cylinder and the face of the piston in a reciprocating internal combustion engine was calculated as a function of space and time throughout the complete four stroke cycle; intake, compression, power and exhaust strokes; with the intake and exhaust valves opening and closing appropriately. Two dimensional flow and simple valve geometry were assumed. The inviscid flowfield was characterized by strong circulation patterns which were influenced by valve location and size, and by engine RPM. The boundary conditions at the intake and exhaust valves are shown to have an important effect on the inviscid calculations. Dissert. Abstr.

N78-22372 Maryland Univ., College Park.
NUMERICAL SOLUTIONS FOR TWO- AND THREE-DIMENSIONAL NON-REACTING FLOWFIELDS IN AN INTERNAL COMBUSTION ENGINE Ph.D. Thesis
Michael Douglas Griffin 1977 190 p
Avail: Univ. Microfilms Order No. 7805028

Fluid dynamic effects were treated with combustion simulated by constant volume heat addition near top-dead-center on the compression stroke. The working fluid was assumed to be air of constant specific heat, with both viscous and inviscid models considered. Two and three dimensional engine models were examined, with the three dimensional models including both rectangular and cylindrical geometries. The difficulties associated with obtaining numerical solutions in cylindrical coordinates for three dimensional nonaxisymmetric problems when the centerline is included in the region of interest were discussed. A new method which avoids the coordinate singularity problems associated with such cases was presented and used to obtain the first k r own stroke inviscid flow solution for a three dimensional model. Dissert. Abstr.

N78-22373*# Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
VIBRATION OF BEARINGS
K. M. Ragulskis, A. Yu. Jurkauskas, V. V. Atstupenas, A. Yu. Vitkute, and A. P. Kulvec Washington NASA Dec. 1977 517 p refs Transl. into ENGLISH of the book "Vibratsiya Podshipnikov" Vilnyus, USSR, Mintis Publishers, 1974 p 1-391
(Grant NSF C-630)
(NASA-TT-F-17449; TT-75-52090) Avail: NTIS HC A22/MF A01 CSCL 13I

Analytical determination of vibrations and friction torque due to rotation taking into account the hydrodynamic action of a lubricating oil film, and determination of the elastic and damping characteristics of bearings and bearing assemblies are some of the problems considered in this book. The methodology and techniques of measuring the dynamic characteristics of bearings are presented. Experimental data and the methodology of statistical analysis are also given. Author

N78-22374*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IMPROVED TIRE/WHEEL CONCEPT Patent Application
Philip M. Harper, Sr., inventor (to NASA) (Boeing Commercial Airplane Co., Seattle) Filed 6 Apr. 1978 12 p Sponsored by NASA
(NASA-Case-LAR-11695-1; US-Patent-Appl-SN-893865) Avail: NTIS HC A02/MF A01 CSCL 01C

A tire and wheel assembly is described in which a low profile pneumatic tire has sidewalls which deflect inwardly under load and a wheel has a rim featuring a narrow central channel and extended rim flanges from the combination. The extended rim flanges support the tire sidewalls under static and dynamic loading conditions to produce a combination particularly suited to aircraft applications. NASA

N78-22375*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH-TORQUE OPEN-END WRENCH Patent Application
Anthony Giandomenico (JPL), James M. Dame (JPL), and Harold Behimer, inventors (to NASA) (JPL) Filed 29 Aug. 1977 10 p
(Contract NAS7-100)
(NASA-Case-NPO-13541-1; US-Patent-Appl-SN-828262) Avail: NTIS. HC A02/MF A01 CSCL 13I

A wrench for tightening nuts in tight situations where pipes or the like passing through the nut prevent access by a typical socket wrench, and where the nuts are too close to one another or to other structures to permit the use of an open end wrench (which must be thick to apply high torque) is reported. The primary novel feature is the use of two wrench elements with gaps, with the first element engaging a nut and the second surrounding the first to apply torque to it, wherein the second element extends over the gap in the first to prevent expansion of the first element which could cause it to slip on the nut. NASA

N78-22376*# National Aeronautics and Space Administration. Pasadena Office, Calif.
IMPROVED BASE DRIVE FOR PARALLELED INVERTER SYSTEMS Patent Application
Satoshi Nagano, inventor to (NASA) (JPL) Filed 16 Feb. 1978 14 p
(Contract NAS7-100)

(NASA-Case-NPO-14163-1; US-Patent-Appl-SN-878541) Avail: NTIS HC A02/MF A01 CSCL 13I

In a paralleled inverter system, a positive feedback current derived from the total current from all of the modules of the inverter system is applied to the base drive of each of the power transistors of all modules, thereby to provide all modules protection against open or short circuit faults occurring in any of the modules, and force more equal current sharing among the modules during turn-on of the power transistors. NASA

N78-22377*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FERROGRAPHIC ANALYSIS OF WEAR PARTICLES FROM SLIDING ELASTOHYDRODYNAMIC EXPERIMENTS

William R. Jones, Jr., H. S. Nagaraj (Mechanical Technology, Inc., Latham, N. Y.), and Ward O. Winer (Georgia Inst. of Tech., Atlanta) Apr. 1978 31 p refs

(NASA-TP-1230; E-9300) Avail: NTIS HC A03/MF A01 CSCL 20K

The Ferrograph was used to analyze wear debris generated in a sliding elastohydrodynamic contact. The amount of wear debris correlates well with the ratio of film thickness to composite surface roughness (A ratio). The general wear level parameter and the wear severity index yielded similar correlations with average A ratios. Essentially all the generated wear particles were of the normal rubbing wear type. The Ferrograph was more sensitive in detecting the wear debris than was the commonly used emission spectrograph. Author

N78-22378# New Mexico Univ., Albuquerque. Bureau of Engineering Research.

HYDRODYNAMIC LUBRICATION WITH WEAR AND ASPERITY CONTACT IN MECHANICAL FACE SEALS Annual Report, 1 Dec. 1976 - 30 Nov. 1978

A. O. Lebeck, J. L. Teale, and R. E. Pierce Jan. 1978 212 p refs

(Contract N00014-76-C-0071)

(AD-A050783; ME-86(78)ONR-414-1) Avail: NTIS HC A10/MF A01 CSCL 11/1

In this report a model is developed which describes lubrication effects caused by circumferential waviness in face seals. This two dimensional model accounts for the effects of hydrodynamic and hydrostatic pressure, fluid film cavitation, surface roughness, asperity contact and load support, and elastic deflection. The fraction of load supported by fluid pressure, relative wear rate, pressure distribution, friction, and leakage are predicted given the waviness, pressure, speed, material, geometry, viscosity, and surface roughness. The model is applicable to heavily loaded, low viscosity seals where partial contact is expected. The results from the model have been compared to available experimental results. The model shows that the magnitude of surface roughness is the most important parameter determining the extent of hydrodynamic lubrication. Seal faces with low roughness are more likely to display hydrodynamic effects than seal faces having larger roughness. GRA

N78-22379# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.

HIGH SPEED ROTOR BALANCING Final Report

Walter D. Pilkey Feb. 1977 12 p refs

(Grants DAAG29-75-G-0055; DAAG29-77-G-0027)

(AD-A050793; UVA/525037/MAE78/101; ARO-12515.6-E) Avail: NTIS HC A02/MF A01 CSCL 13/9

This report summarizes the accomplishments of a study exploring new methods for balancing, analyzing and designing flexible rotating shafts. It is assumed that the balancing problem is an identification/optimization problem. Emphasis is given to computational optimization formulations. In addition to balancing techniques, an optimal design procedure for rotor bearing systems is proposed. Also, modal and direct integration transient analysis methods are developed. Finally, a numerically stable analysis approach is formulated and implemented. Author (GRA)

N78-22380# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.

DEVELOPMENT OF ANALYTICAL AND EMPIRICAL SYSTEMS FOR PARAMETRIC STUDIES OF DESIGN AND FABRICATION OF WELDED STRUCTURES Final Report, 1 Dec. 1974 - 30 Nov. 1977

Vassilios J. Papazoglou and Koichi Masubuchi 30 Nov. 1977 216 p refs

(Contract N00014-75-C-0469)

(AD-A050908) Avail: NTIS HC A10/MF A01 CSCL 13/5

Part I of the report covers the development of a monograph entitled 'Analysis of Design and Fabrication of Welded Structures.' The monograph deals with the prediction of stresses, strains and other effects produced by welding. Part II covers the development of analytical means for predicting and controlling weld distortion in welded aluminum structures. Distortion in welded structures is caused by three fundamental dimensional changes, namely transverse shrinkage, longitudinal shrinkage, and angular change. During the fabrication of actual structures, such as ships, airplanes, and buildings which have various types of joints, these dimensional changes are combined. Therefore, shrinkage distortion that occurs in structures can be extremely complex. After a brief introduction, Section 2.2 discusses thermal stresses during welding, residual stresses, and distortion in a general manner. The subsequent sections up to Section 2.6 discuss the analytical and experimental investigations carried out at M.I.T. on the prediction of various fundamental types of distortion. Finally, Section 2.7 deals with methods of distortion reduction, as they were tested by various investigators at M.I.T.

Author (GRA)

N78-22381# General Electric Co., Schenectady, N. Y. Gas Turbine Div.

HIGH TEMPERATURE GAS TURBINE ENGINE COMPONENT MATERIALS TESTING PROGRAM, TASK 1 Monthly Technical Progress Report, 1-30 Sep. 1977

M. B. Cutrone 15 Oct. 1977 18 p

(Contract EX-76-C-01-1765)

(FE-1765-37; MTPR-27) Avail: NTIS HC A02/MF A01

Further evaluation of deposits from the 500 ppM ash liquid tests were completed and are reported. Preparations for confirmation gas tests are nearly complete, hardware is available, and pre-test check out runs will start in early October. Alkali conversion tests demonstrate that sodium in insoluble forms in the fuel, is converted to soluble, corrosive salts during combustion of coal derived liquids. Little potassium is similarly converted. ERA

N78-22382# United Technologies Corp., Farmington, Conn. Power Systems Div.

DEVELOPMENT OF HIGH-TEMPERATURE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATE. PHASE 1: PRELIMINARY COMBUSTOR DESIGN

Nils G. Carlson Nov. 1977 142 p refs

(Contract EX-76-C-01-2292)

(FE-2292-11) Avail: NTIS HC A07/MF A01

Three low-Btu gas combustor designs were preliminarily defined and analytically assessed. Major design considerations included low emissions, safety, durability and good maintainability. On the basis of the design considerations and operating criteria, the premix combustion concept was selected for each combustor concept along with an annular mechanical design. Premixing has a superior capability to control oxides of nitrogen emissions (NO/sub x) at the required high operating temperature levels, while the annular construction significantly reduces the amount of surface area requiring cooling. After selecting a candidate combustion process and mechanical design approach three different liner cooling concepts were evaluated, each reflecting a varying degree of performance capability and development risk. ERA

N78-22383# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

ELECTRON BEAM WELDING TITANIUM ELEMENTS OF AN AIRCRAFT STRUCTURE [ETUDE DU SOUDAGE PAR FAISCEAU D'ELECTRONS D'ELEMENTS EN TITANE DE STRUCTURE D'UN AVION]

Paris Assoc. Aeron. et Astronautique de France 1977 35 p In FRENCH Presented at the Colloq. on Mater., Bordeaux, 21 Apr. 1977

(AAAF-NT-77-44; DGT-12-675; ISBN-2-7170-0469-6) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

Electron beam welding of vital aircraft titanium alloy parts is dealt with. Parameters for optimum welding are considered: welding speed, power requirement, and focusing. These parameters were determined from metallurgical and mechanical tests, mainly fatigue tests. Characteristics of the welded joints and their control after welding, are reported. The following results were obtained: welding speed: 1.4 m/mn; power: 9 to 10 kW (50 kV; 180 to 200 mA); focusing: low. A fatigue resistance reduction of the joint with respect to the base metal of the order of 10 % should be taken into account. ESA

N78-22384# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France). Lab. Soudage.
ELECTRON BEAM WELDING OF NICKEL ALLOYS [SOUDAGE PAR FAISCEAU D'ELECTRONS DES ALLIAGES DE NICKEL]
B. Blanchet Assoc. Aeron. et Astronautique de France 1977 24 p In FRENCH Presented at the Colloq. on New Mater., Bordeaux, 20-22 Apr. 1977
(AAAF-NT-77-34; ISBN-2-7170-0459-9) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Experience with electron beam welding of nickel chromium alloys for application in turbojet construction is reported. Among the difficulties encountered were surface defects in the melting zone, defects at the root of the melting zone, and fissuring. The weldability study included micrographic examination of the welded zones, examination of the influence of welding speed, and examination of the grain size effect. ESA

N78-22385# Booz-Allen and Hamilton, Inc., Bethesda, Md. Transportation Consulting Div.
TRANSIT BUS PROPULSION SYSTEMS ALTERNATE POWER PLANT INSTALLATION Final Report
Sep. 1977 42 p
(Contract DOT-UT-10008)
(PB-276612/9; UMTA-IT-06-0025-78-2) Avail: NTIS HC A03/MF A01 CSCL 13F

Installation characteristics of the most suitable engines for each of the three prototype Transbus designs are presented. Listed and illustrated are: (1) the engine compartments of the three prototype Transbus designs; (2) the candidate engines; and (3) the candidate engines fitted into the three prototypes. The results presented show that two engine types, the 4-cycle diesel engine and the gas turbine engine, may challenge the 2 cycle diesel engine for the transit coach market. Author

N78-23027*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MINIMUM ENERGY CONTROL OF A CLASS OF ELECTRICALLY DRIVEN VEHICLES
Yilmaz E. Sahinkaya *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 387-421 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 13F

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-22386 Missouri Univ., Columbia.
BAYESIAN NONPARAMETRIC INFERENCE IN RELIABILITY THEORY Ph.D. Thesis
Purushottam Waman Laud 1977 117 p
Avail: Univ. Microfilms Order No. 78-03736

The extended gamma process, is defined and used to put a prior on the class of hazard functions. The posterior distribution of this process is obtained from censored as well as exact observation. Bayes estimates of the hazard function and the cumulative distribution function are found under a general squared error loss function. This stochastic process is also used to put a prior on the class of non-decreasing hazard rates as well as on the class of non-increasing hazard rates. Computational procedures are developed for the above estimates and some computer programs are included. Each obtained estimate is illustrated by a simulated example and graphs of prior and posterior estimates. Dissert. Abstr.

N78-22387 Rensselaer Polytechnic Inst., Troy, N. Y.
APPLICATION OF SURFACE ACOUSTIC WAVES TO NONDESTRUCTIVE EVALUATION OF SEMICONDUCTOR SURFACES Ph.D. Thesis
Haim Gilboa 1977 225 p
Avail: Univ. Microfilms Order No. 78-02854

A study of the electrical properties of semiconductors using the interaction between surface acoustic waves and a semiconductor in the separated medium configuration (the SAW convolver) was performed. This study was conducted towards developing a new technique for nondestructive evaluation of semiconductor surfaces using surface acoustic waves. Photoconductivity response time for various semiconductors was obtained by observing the transient response of the attenuated delay line output after a pulse of light is applied to the semiconductor. The SAW convolver was used to determine the absorption edge and the location of surface states in the energy gap. The spectral response of the delay line attenuation and the dc transverse acoustoelectric voltage were used to monitor changes in the semiconductor conductivity, and the charge trapped in the surface states due to optical excitation. Dissert. Abstr.

N78-22388# Royal Aircraft Establishment, Farnborough (England).
APPLICATION TO LIFE PREDICTION OF DESIGN DATA DERIVED FROM FATIGUE TESTS WITH SERVICE-LIKE LOAD SEQUENCES
D. Schuetz and H. Lowak Aug. 1977 53 p refs Transl. into ENGLISH of "Zur Verwendung Von Bessungsunterlagen aus Versuchen mit Betriebsahnlichen Lastfolgen zur Lebensdauerabschatzung", Rept. FB-109, Lab. fuer Betriebsfestigkeit, Darmstadt, 1976
(RAE-Lib-Trans-1939; BR62233; FB-109) Avail: NTIS HC A04/MF A01

Statistically verified life curves were established for a load sequence and cumulative frequency distribution typical of the wing structure of a transport aircraft. It was demonstrated how life curves for other sequences could be predicted from this test data, using a relative miner rule data. It was found that for large differences between the sequence for which an estimate was to be made and that for which design data was available, use of the relative miner rule does not predict life better than the use of usual miner rule. A suitable correction was applied to the specimens, using empirically derived data, and provided an effective refinement to the relative miner rule giving very accurate life predictions. Author

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-22389 Oklahoma State Univ., Stillwater.
LARGE DEFLECTION ANALYSIS OF DISCRETE-ELEMENT THIN PLATES Ph.D. Thesis
Saroj Leesavan 1977 171 p
Avail: Univ. Microfilms Order No. 78-01285

A method of analysis was developed for thin elastic plates which includes the effects of the membrane behavior on the vertical load resistance of the plates. A discrete-element was used in this study and the plate structure was represented by two structural systems. A bending model resists the vertical load by bending and a membrane model which resists both vertical and inplane loads by the stretching or contracting of the bar elements of the model. Although the behavior of the structure was nonlinear, the material properties were linearly elastic. Compatibility of the models and equilibrium were satisfied by repeated solutions of the two systems. A computer program, which permits a general description of the plate structure to

include material properties, structure shape, load, and boundary conditions, were developed in FORTRAN language.
Dissert. Abstr.

N78-22390 Cornell Univ., Ithaca, N. Y.
THE BEHAVIOR AND STRENGTH OF THIN-WALLED COMPRESSION ELEMENTS WITH LONGITUDINAL STIFFNESS Ph.D. Thesis
Thomas Patrick Desmond 1977 282 p
Avail: Univ. Microfilms Order No. 78-01649

A design method is presented for longitudinally stiffened compression members, having edge or intermediate stiffeners. Design procedures are developed for members that are adequately as well as partially stiffened, where partially stiffened elements are those with less than adequate stiffener rigidity. A critical buckling analysis is presented based on existing linear stability theories. The nonlinear analysis shows that the stiffener buckles by deflecting perpendicular to the plane of the plate to be stiffened at or below the critical stress corresponding to that of a simply supported stiffened plate. A stiffener requirement is developed based on a critical buckling criterion. Based on an ultimate strength criterion, stiffener requirements are formulated for design purposes, which provide a minimum required stiffener rigidity to adequately support the stiffened plate element.
Dissert. Abstr.

N78-22391 Illinois Univ., Urbana-Champaign.
ELASTODYNAMIC ANALYSIS OF A PROPAGATING FINITE CRACK Ph.D. Thesis
Kwang Soo Kim 1977 81 p
Avail: Univ. Microfilms Order No. 78-04050

A method was developed to obtain the transient dynamic stress intensity factors for a class of plane-strain finite crack problems in which a crack may propagate at nonuniform rate under the action of an arbitrary time-dependent normal traction on the crack face. Integral transforms were applied to the equations of motion and general solutions for the field variables were obtained in the transform space. A two-dimensional singular integral equation was obtained for the rotation of the crack surface. As example problems diffraction of a uniformly incident dilatational wave by (1) a stationary crack, (2) a propagating crack with constant speed, (3) a suddenly stopping crack after propagating with constant speed was considered. Dynamic stress intensity factors were computed for a wide range of time in each problem and a number of interesting points were examined.
Dissert. Abstr.

N78-22392 Illinois Univ., Urbana-Champaign.
LARGE DEFLECTIONS AND STABILITY OF CIRCULAR RINGS AND ARCHES Ph.D. Thesis
Yun Ko Liao 1977 103 p
Avail: Univ. Microfilms Order No. 78-04069

The elastic deflection and stability of circular rings and arches under nonuniform loading were studied. The analysis is based upon large displacement, small strain theory and employs finite element techniques. The element used is a curved beam element with twelve degrees of freedom. The hoop strain of the curved beam is expressed in terms of the displacement vector of its centroidal axis. All quadratic terms in the displacement components are retained. The hoop-strain formula leads to a strain energy expression that includes all quartic terms in the displacement components. Results have been obtained for the following cases: concentrated load, uniformly distributed pressure, special nonuniform pressure and normally directed steady wind load.
Dissert. Abstr.

N78-22393 Notre Dame Univ., Ind.
CONSTITUTIVE EQUATIONS FOR RATE DEPENDENT INELASTIC BEHAVIOR WITH FINITE DEFORMATIONS Ph.D. Thesis
Phillip David Pattillo 1978 141 p
Avail: Univ. Microfilms Order No. 78-02876

Preliminary sections of the study were devoted to the development of a set of constitutive equations applicable to a wide variety of viscoelastic-viscoplastic phenomena. The inelastic deformation parameters are divided into two classes representing respectively the effects of recoverable and irrecoverable processes on irrecoverable deformation. A formalization of the constitutive equations resulting from such a division of the inelastic deformation parameters is presented. Elastic-viscoplasticity is introduced as a topic separate from viscoelastic-plasticity. The topic discussion closes with comments regarding the difficulties involved in attempting to compare elastic-viscoplasticity with viscoelastic-plasticity. Sample calculations are carried out for a hypothetical material model. The material properties introduced are determined and then used to study a simple two-dimensional loading path.
Dissert. Abstr.

N78-22394 Michigan State Univ., East Lansing.
MEASUREMENT OF THE ELASTIC-PLASTIC BOUNDARY AROUND COLDWORKED FASTENER HOLES Ph.D. Thesis
Saravut Poolsuk 1977 147 p
Avail: Univ. Microfilms Order No. 7803547

The existing theories developed for the coldworked hole are discussed, their assumptions and deficiencies pointed out. Two experimental techniques were developed to evaluate the existing theories. The two techniques used to locate the elastic-plastic boundary were foil gages and thickness change measurement. To test the validity of the theories, two kinds of aluminum with two different thicknesses were used as specimens. Holes in the circular specimens were coldworked with four different sizes of the oversize mandrel. This industrial coldworking process was found to give nonuniform deformation through the specimen thickness. The final results of the measurements around the coldworked holes obtained by the thickness change method were presented in dimensionless form for hole size, amount of coldwork, and material.
Dissert. Abstr.

N78-22395 Illinois Univ., Urbana-Champaign.
AN INTEGRAL EQUATION SOLUTION FOR A BOUNDED, PLANE, ELASTIC BODY CONTAINING A CRACK: IN-PLANE DEFORMATIONS Ph.D. Thesis
Thomas Joseph Rudolphi 1977 68 p
Avail: Univ. Microfilms Order No. 7804137

A set of coupled equations, involving integrals over the outer boundary and the line of the crack, was obtained by superimposing the Fourier integral solution of a crack problem in an unbounded medium upon the boundary integral equation solution of the problem in the unflawed medium. The stress intensity factors at the crack tips were defined and directly incorporated into the formulation. For a numerical solution, the set of coupled integral equations are approximated by a set of simultaneous, linear, algebraic equations with the stress intensity factors and crack surface displacements ensuing directly from the numerical solution. A fairly general FORTRAN computer program was developed to perform the numerical solution and several example problem were presented.
Dissert. Abstr.

N78-22396 Illinois Univ., Urbana-Champaign.
NON-LINEAR WAVE PROPAGATION IN HELICAL SPRINGS BY THE METHOD OF CHARACTERISTICS AND FINITE ELEMENT METHOD Ph.D. Thesis
Sunil Kumar Sinha 1977 131 p
Avail: Univ. Microfilms Order No. 78-04159

The problem considered here is that of a helical spring which is fixed at one end and impacted at the other end with sufficient velocity so as to cause contact between the coils. The problem has been solved by two different methods viz., the method of characteristics and the finite element method. In the first method, the equations of motion for the dynamic response of a helical spring are derived and the method of nonlinear characteristics is employed to solve the coupled partial differential equations. In the second method, a two noded helical element, with two degrees of freedom at each node, is developed. A comparison of the two methods is made and it is found that the assumption of the coils being deformable under contact loads is a more realistic one.
Dissert. Abstr.

N78-22397 Pennsylvania State Univ., University Park.
ANALYSIS OF MULTI-CONNECTED AXISYMMETRIC SHELLS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Shu-Ting Lin 1977 104 p
Avail: Univ. Microfilms Order No. 78-03343

Meridional and normal polynomial displacement functions were written in terms of eight generalized coordinates corresponding to six external and two internal degrees of freedom.

Comparison of results obtained using the new element with those generated from known analytic solutions for five simple configurations showed improved accuracy for each case investigated. In addition, vastly improved results were obtained when compared to those generated from currently used conical elements. The improved accuracy was especially evident at points of constraints, indicating a better ability in evaluating discontinuity stresses. Dissert. Abstr.

N78-22398 Michigan State Univ., East Lansing.
AN EXPERIMENTAL STUDY OF CRACK INITIATION AND GROWTH FROM COLDWORKED HOLES Ph.D. Thesis
Nopporn Chandawanich 1977 203 p
Avail: Univ. Microfilms Order No. 7803472

The experimental studies investigating the change of residual strain during crack initiation, the stress intensity factor for the crack emanating from a circular hole, and the strains ahead of a crack tip were described. The specimens were subjected to low cycle fatigue conditions. Analytical procedures were evaluated based on correlation with the test data. These procedures included elastic/plastic analysis which was utilized to determine the stress-strain distribution surrounding the fastener holes and ahead of the crack tip. The experimental data showed that the moire method is acceptable for measuring the strains in this investigation. Crack growth rate and interferometric displacement gage techniques were used to determine the stress intensity factor. Dissert. Abstr.

N78-22399 Cornell Univ., Ithaca, N. Y.
STRUCTURAL OPTIMIZATION USING GEOMETRIC PROGRAMMING Ph.D. Thesis
Subramanian Ramamurthy 1977 164 p
Avail: Univ. Microfilms Order No. 78-06316

A study of the numerical performance of the solution algorithm for the generalized geometric programming (GGP) problem was carried out. In order to examine the efficacy of the GGP algorithm to solve structural engineering problems, two design problems-light gage steel design and prestressed concrete design was chosen. In the light gage steel design problems minimum weight designs of two different cross sections namely, hat sections and channel sections were obtained. In the other design problem solved, determination of minimum cost design of one-way prestressed concrete slabs via minimum prestressing force designs was illustrated. Beyond a certain depth, the need for supplementary non-prestressed reinforcement to obtain more economical designs is shown. Dissert. Abstr.

N78-22400 Arizona Univ., Tucson.
BUCKLING BEHAVIOR OF SYMMETRIC ARCHES Ph.D. Thesis
Samih Shaker Qaqish 1977 160 p
Avail: Univ. Microfilms Order No. 7805782

The stability of inextensional, slender circular, parabolic, and catenary arches with variable cross sections at large deflections was studied. Clamped and hinged end supports, as well as vertically distributed loads over the arch axis, vertical downward point loads at the crown, and non-symmetrical loads were considered. The derivation of the differential equations of the arch was based upon the assumption that cross sections of the undeformed state remain undeformed and plane, but not necessarily normal to the reference axis during deformation. The developed differential equations are exact in the sense that no restriction was placed on the magnitudes of the deformations. Dissert. Abstr.

N78-22401*# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF AN IMPROVED METHOD OF CONSOLIDATING FATIGUE LIFE DATA Final Contractor Report, Sep. 1975 - Aug. 1977
B. N. Leis and S. G. Sampath Feb. 1978 80 p refs
(Contract NAS1-14171)
(NASA-CR-145312; G-6309-1/1) Avail: NTIS HC A05/MF A01 CSCL 20K

A fatigue data consolidation model that incorporates recent advances in life prediction methodology was developed. A combined analytic and experimental study of fatigue of notched 2024-T3 aluminum alloy under constant amplitude loading was carried out. Because few systematic and complete data sets for 2024-T3 were available in the program generated data for fatigue crack initiation and separation failure for both zero and nonzero mean stresses. Consolidations of these data are presented. Author

N78-22402*# Mechanical Technology, Inc., Latham, N. Y.
DEVELOPMENT OF PROCEDURES FOR CALCULATING STIFFNESS AND DAMPING PROPERTIES OF ELASTOMERS IN ENGINEERING APPLICATIONS. PART 4: TESTING OF ELASTOMERS UNDER A ROTATING LOAD Contractor Report, Oct. 1975 - Mar. 1977
M. S. Darlow and A. J. Smalley Nov. 1977 87 p refs
(Contract NAS3-18546)
(NASA-CR-135355; MTI-78TR18-Pt-4) Avail: NTIS HC A05/MF A01 CSCL 20K

A test rig designed to measure stiffness and damping of elastomer cartridges under a rotating load excitation is described. The test rig employs rotating unbalance in a rotor which runs to 60,000 RPM as the excitation mechanism. A variable resonant mass is supported on elastomer elements and the dynamic characteristics are determined from measurements of input and output acceleration. Five different cartridges are considered: three of these are buttons cartridges having buttons located in pairs, with 120 between each pair. Two of the cartridges consist of 360 elastomer rings with rectanglar cross-sections. Dynamic stiffness and damping are measured for each cartridge and compared with predictions at different frequencies and different strains. Author

N78-22403*# McDonnell Aircraft Co., St. Louis, Mo.
DESIGN AND FABRICATION OF A RADIATIVE ACTIVELY COOLED HONEYCOMB SANDWICH STRUCTURAL PANEL FOR A HYPERSONIC AIRCRAFT Final Report
D. A. Ellis, L. L. Pagel, and D. M. Schaeffer Washington NASA Mar. 1978 163 p refs
(Contract NAS1-13939)
(NASA-CR-2957) Avail: NTIS HC A08/MF A01 CSCL 11D

The panel assembly consisted of an external thermal protection system (metallic heat shields and insulation blankets) and an aluminum honeycomb structure. The structure was cooled to temperature 442K (300 F) by circulating a 60/40 mass solution of ethylene glycol and water through dee shaped coolant tubes nested in the honeycomb and adhesively bonded to the outer skin. Rene'41 heat shields were designed to sustain 5000 cycles of a uniform pressure of + or - 6.89kPa (+ or - 1.0 psi) and aerodynamic heating conditions equivalent to 136 kW sq m (12 Btu sq ft sec) to a 422K (300 F) surface temperature. High temperature flexible insulation blankets were encased in stainless steel foil to protect them from moisture and other potential contaminates. The aluminum actively cooled honeycomb sandwich structural panel was designed to sustain 5000 cycles of cyclic in-plane loading of + or - 210 kN/m (+ or - 1200 lbf/in.) combined with a uniform panel pressure of + or - 6.89 kPa (±1.0 psi). Author

N78-22404*# Case Western Reserve Univ., Cleveland, Ohio. Mechanical and Aerospace Engineering.
TREATMENT OF LOW STRAINS AND LONG HOLD TIMES IN HIGH TEMPERATURE METAL FATIGUE BY STRAIN-RANGE PARTITIONING Final Report
S. S. Manson and Ronald Zab Aug. 1977 64 p refs Sponsored in part by NASA
(Contract W-7405-eng-26)
(NASA-CR-156923; ORNL-SUB-3988-1) Avail: NTIS HC A04/MF A01 CSCL 20K

A procedure for treating creep-fatigue for low strainranges and long hold times is outlined. A semi-experimental approach, wherein several cycles of the imposed loading is actually applied to a specimen in order to determine the stable hysteresis loop, can be very useful in the analysis. Because such tests require only a small fraction of the total failure time, they are not inherently prohibitive if experimental equipment is available. The need for accurate constitutive equations is bypassed because the material itself acts to translate the imposed loading into the responsive hysteresis loops. When strainrange partitioning has been applied in such cases very good results have been obtained. ERA

N78-22405# International Harvester Co., Hinsdale, Ill.
ESTABLISHMENT OF ULTRASONIC INCLUSION RATING METHOD FOR TORSION BAR SPRING
Clarence J. Carter and Raymond A. Celliti Warren, Mich. TARADCOM Aug. 1977 56 p
(Contract DAAE07-75-C-0088)
(AD-A050807; TARADCOM-12304) Avail: NTIS HC A04/MF A01 CSCL 11/6

The ultrasonic inspection approach to evaluating and rating material quality has been successfully utilized as a supplemental method by steel producers and consumers for reliable quality assessment of raw material and end item structures. By coupling the ultrasonic detection unit with rapid electronic data processing equipment, an accurate and reliable quality rating system capable of detecting small defects is provided. GRA

N78-22406# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ON THE EXISTENCE OF AN ELASTIC POTENTIAL FOR A SIMPLE MATERIAL WITHOUT MEMORY
Eli Sternberg and J. K. Knowles Jan. 1978 24 p refs
(Contract N00014-75-C-0196)
(AD-A050582; TR-39) Avail: NTIS HC A02/MF A01 CSCL 20/11

It is shown that a compressible elastic body not necessarily homogeneous or isotropic - is hyperelastic provided the work done by all external forces acting on an arbitrary part of the body vanishes for every sufficiently smooth cyclic motion, in which each material point returns to its initial position with a velocity equal to its initial velocity. Author (GRA)

N78-22407# Syracuse Univ., N. Y. Dept. of Electrical Engineering.
CIRCUMFERENTIAL DISTRIBUTION OF SCATTERING CURRENT AND SMALL HOLE COUPLING FOR THIN FINITE CYLINDERS
Harvey K. Schuman Dec. 1977 44 p refs
(Contract F30602-75-C-0121)
(AD-A050754; RADC-TR-77-412) Avail: NTIS HC A03/MF A01 CSCL 20/3

The scattering current induced on a thin, finite, conducting cylinder immersed in a 'theta' polarized E-field is studied. Particular attention is paid to the circumferentially non-uniform mode. This non-uniformity is shown significant (peak-to-average ratio of 3 db at cylinder mid-length) for wavelength long cylinders with diameters as small as 0.067 lambda. Also investigated is the relationship between scattering current and cavity response patterns for narrow, thin-walled cylindrical cavities with small holes through which energy is coupled. It is demonstrated theoretically, with experimental verification, that the circumferential variation of scattering current strongly affects the fields within thin cylindrical cavities having apertures with small circumferential extents. It is noted, however, that for most thin-body radiation and scattering problems (in contrast with aperture coupling) only the uniform current mode is significant. Author (GRA)

N78-22408# Argonne National Lab., Ill. Components Technology Div.
ANALYSIS OF THE BALLOONING DEFORMATION OF AN INTERNALLY PRESSURIZED THIN-WALL TUBE DURING FAST THERMAL TRANSIENTS
E. I. H. Lin 1977 20 p refs Presented at the 4th Intern. Conf. on Structural Mech. in Reactor Tech., San Francisco, 15-19 Aug. 1977
(Contract W-31-109-eng-38)
(CONF-770807-48) Avail: NTIS HC A02/MF A01

A large-strain time-dependent thermoplastic analysis was developed for the ballooning deformation of a thin wall tube subjected to internal pressure, axial loading, and fast thermal transients. This deformation initiated with the onset of plastic instability in the material, the onset being determined by a plastic instability criterion for strain-rate sensitive materials. The interaction among the local ballooning geometry, the state of stress, and the plastic flow process was considered, and integration of the flow equations yields the local curvature and the states of stress and strain in the vicinity of the maximum ballooning site. The effects of axial constraint and heating rate were also discussed. The analysis was applied to a LWR Zircaloy cladding subjected to a constant heating rate and a range of internal pressures. The results agree very well with experimental strain-time data obtained from tube-burst tests. In most cases, the time of rupture was accurately predicted despite the lack of complete material-property data. ERA

N78-22409# Hanford Engineering Development Lab., Richland, Wash.
SOME OBSERVATIONS REGARDING SPECIMEN SIZE CRITERIA FOR FATIGUE-CRACK GROWTH RATE TESTING
Lee A. James Sep. 1977 25 p refs
(Contract EY-76-C-14-2170)
(HEDL-TME-77-87) Avail: NTIS HC A02/MF A01

The techniques of linear-elastic fracture mechanics were used to characterize the fatigue-crack growth behavior of Types 304 and 316 stainless steels at elevated temperatures. Several specimen designs and sizes were employed in an attempt to shed some light upon the minimum acceptable specimen size required to produce reliable crack growth rate data in these materials. In general, it was found that the specimen size criteria based upon monotonic yield strength originally proposed by an ASTM Task Group is unnecessarily restrictive, and an alternate criterion based upon the flow stress is less restrictive while producing acceptable results. ERA

N78-22410# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HIGH TEMPERATURE LOW CYCLE FATIGUE TESTING MACHINE
Jean-Louis Chaboche, Humbert Policella, and Henri Kaczmarek Oct. 1977 27 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-474)
(ONERA-NT-1977-10) Avail: NTIS HC A03/MF A01

The ONERA Structures Department has been equipped for four years with a test rig for low cycle fatigue at high temperature. Account being taken of the specific objectives of the research work carried out on characterization of materials behavior with a view to structures computation, the method used in this rig makes use of cylindrical tension-compression specimens, and of a system of longitudinal extensometry. The installation and its characteristics and possibilities, are described and the various techniques that can be used at high temperature for this type of specimen are reviewed. Discussions on behavior and damage models in the low cycle fatigue domain and on the definition of the equivalent useful length are annexed. Author (ESA)

N78-23037# European Space Agency, Paris (France).
MEASUREMENT OF NON-DIAGONAL GENERALIZED DAMPING RATIOS DURING GROUND VIBRATION TESTS
Gabriel Coupry *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 53-65 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 239-244 Original report in FRENCH previously announced as A77-50440 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

42 GEOSCIENCES (GENERAL)

N78-22411# Israeli Program for Scientific Translations Ltd., Jerusalem.
GEOCHEMISTRY OF ELEMENTS IN THE SUPERGENE ZONE
A. I. Perelman and A. A. Levinson, ed. 1977 274 p refs Transl. into ENGLISH of the book "Geokhimiya Elementov v Zone Gipergeneza" Moscow, Nedra Press, 1972 274 p Sponsored by United States-Israel Binational Sci. Found.
(TT-75-50016; ISBN-0-7065-1565-X) Copyright. Avail: NTIS HC A12/MF A01

The basic principles of supergene geochemistry were further developed and expanded. Special emphasis was placed on the clarke of concentration, which is a comparison of the geochemical abundance in a system with the average composition of the

lithosphere. A new system of concepts was proposed: thalassophilic, biophilic, and technophilic properties. Emphasis were placed on the aqueous and biogenic migration of the elements, the geochemical barriers at which they are concentrated, and zones of leaching from which they are removed historical geochemistry of the elements and their behavior in the anthroposphere (the sphere of human influence). For individual titles, see N78-22412 through N78-22414.

N78-22412# Israeli Program for Scientific Translations Ltd., Jerusalem.

THE SUPERGENE ZONE, PART 1 **c46**

In its Geochem. of Elem. in the Supergene Zone 1977 p 1-39 refs (For availability see N78-22411 13-42)

Copyright. Avail: NTIS HC A12/MF A01

The word supergene is used in a much wider sense in the Soviet literature than in the English literature, where it is effectively limited to supergene enrichment processes associated with ore minerals. In the Soviet literature, supergene refers to the upper part of the earth's crust characterized by low temperatures and pressures. Within this zone, weathering takes place and fluid transport (by surface waters, groundwaters, brines, oceans) occurs; this zone also includes the biosphere, and the lower part of the atmosphere (certainly at least to those elevations from which precipitation takes place). Author

N78-22413# Israeli Program for Scientific Translations Ltd., Jerusalem.

THE GEOCHEMISTRY OF AERIAL MIGRANTS, PART 2 **c45**

In its Geochem. of Elem. in the Supergene Zone 1977 p 40-96 refs (For availability see N78-22411 13-42)

Copyright. Avail: NTIS HC A12/MF A01

The chemical elements oxygen, hydrogen, carbon, nitrogen, iodine and the inert gases readily enter into the atmosphere. The interrelationships and cycles of the aerial migrants within the lithosphere are explored and various reactions are described. One of the more important exchange processes is oxidation-reduction. Solar energy, through photosynthesis, has produced a sharp oxidizing-reducing zone in a layer a few centimeters thick; this zone represents a change from an oxidizing to a reducing environment. The strongest reducing conditions occur in the biosphere in areas with a rapid decomposition of organic matter, rather than at great depths. The exceptional role of carbon is due to the fact that it is a geochemical accumulator of solar energy. P.R.A.

N78-22414# Israeli Program for Scientific Translations Ltd., Jerusalem.

THE GEOCHEMISTRY OF AQUEOUS MIGRANTS, PART 3 **c43**

In its Geochem. of Elem. in the Supergene Zone 1977 p 97-246 refs (For availability see N78-22411 13-42)

Copyright. Avail: NTIS HC A12/MF A01

The role of water in the migration of a number of elements is discussed. Solubility is to a large extent the determining factor for such migration. Natural bodies of water and the water runoff following precipitation are important migration routes for many elements. The formation of salts following evaporation also plays a role in the distribution of elements in the earth's crust. The natural distribution and importance to man of a number of elements are discussed. P.R.A.

N78-22415# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

FURTHER CONTRIBUTIONS FROM THE FEDERAL REPUBLIC OF GERMANY TO THE 16TH GENERAL ASSEMBLY OF THE INTERNATIONAL UNION FOR GEODESY AND GEOPHYSICS [WEITERE BEITRAEGE AUS DER BUNDESREPUBLIK DEUTSCHLAND ZUR VORLAGE BEI DER 16. GENERALVERSAMMLUNG DER INTERNATIONALEN UNION FUER GEODAESIE UND GEOPHYSIK]

1977 68 p refs Proc. of Meeting held at Grenoble, France, 1975

(Ser-B-221-Mitt-139) Avail: NTIS HC A04/MF A01

Papers are presented in the field of geodesy and geodetic networks. The following topics are dealt with: degree of best fitting polynomials, direct gravimetrical determination of geoid undulation differences, smoothing of Laplace discrepancies, geometric adjustment of Western European Satellite Triangulation, least square adjustment of extensive geodetic networks, numerical fitting of trilateration networks, zero point stability of laser ranging system, Wetzell satellite observation station, interval analysis in adjustment computations, longitude determination accuracy using a circumzenithal astrolabe, astrogeodetic geoid determination, temperature stability of gravimeter and Doppler point positioning using the NNSS broadest ephemeris. For individual titles, see N78-22416 through N78-22428.

N78-22416 Karlsruhe Univ. (West Germany) Inst. fuer Geodaesie.

ON ESTIMATION OF THE DEGREE OF BEST FITTING POLYNOMIALS **c46**

Joachim Arnold *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 5-12 refs (For availability see N78-22415 13-42)

Avail: NTIS HC A04/MF A01

The fitting of polynomials to discrete and noisy values of a dependent variable plays a fundamental role in the analysis of observations of natural, measurable processes. This technique is therefore very important for geodetic problems. While questions on the best type of polynomial (monomials or orthogonal polynomials) or on the most stable algorithm (reduction of the normal equations or transformation of the observation equations by the Gram-Schmidt-process or House-Holder transformation) concern the numerical solving of a mathematical problem, the optimum degree of the fitting polynomial is an individual and characteristic property of the data-series to be analyzed. Optimum means that the fit is as close as possible in the observations and as smooth as possible between the observations. Because closeness and smoothness are contrary conditions it is necessary to find a compromise for the determination of the best degree. Therefore, several criteria for judging the goodness of fit are discussed without their applicability being restricted to polynomial approximations. Author (ESA)

N78-22417 Technische Universitaet, Hanover (West Germany). Inst. fuer Theoretische Geodaesie.

A METHOD OF DIRECT GRAVIMETRICAL DETERMINATION OF DIFFERENCES OF GEOID UNDULATIONS **c46**

Hermann Drewes *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Fed. Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 13-20 refs (For availability see N78-22415 13-42)

Avail: NTIS HC A04/MF A01

The Gravimetric leveling reduces the determination of relative geoid undulations by the formula of Stokes to some simple procedures of least squares prediction and the summation of the predicted values. Absolute undulations are obtained by transformation with at least three identical points. The accuracy of differences of geoid undulations is in good agreement with practical determinations of several authors. Author (ESA)

N78-22418 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

SMOOTHING OF LAPLACE DISCREPANCIES **c43**

Dieter Ehlert *In its* Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 21-26 refs (For availability see N78-22415 13-42)

Avail: NTIS HC A04/MF A01

Laplace azimuths are used in large triangulation networks to prevent directional distortions. Azimuth observations of a lesser quality are often available at points in the net. These observations are only of very restricted interest as Laplace control as they tend to distort the accuracies in the neighborhood. An application of the method of collocation to free the Laplace azimuths of noise is demonstrated. An example from the German Primary Triangulation is used to illustrate the usefulness of the solution. Author (ESA)

N78-22419 Bayerische Akademie der Wissenschaften, Munich (West Germany). Bayerische Kommission fuer die Internationale Erdmessung.

GEOMETRIC ADJUSTMENT OF WESTERN EUROPEAN SATELLITE TRIANGULATION (SOLUTION 1975) **c43**

Walter Ehrnsperger *In* Inst. fuer Angew. Geodaesie Further

Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 27-42 refs Sponsored by Deut. Forschungsgemeinschaft (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

Based on 2612 reduced plates, i.e., 72% of the total sum so far submitted to the Computing Center, Munich, some different solutions of the Western European Satellite Triangulation (WEST) were computed. The results were compared with other geodetic networks. Author (ESA)

N78-22420 Stuttgart Univ. (West Germany). Inst. fuer Anwendungen der Geodaesie im Bauwesen.

A RIGOROUS NON-LINEAR LEAST SQUARE ADJUSTMENT OF EXTENSIVE GEODETIC NETWORKS **c43**

L. Gruendig and K. Linkwitz *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 43-51 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

A new method for a rigorous least square adjustment with observed distances and directions is presented. Starting with nonlinear normal equations and approximative values for the unknown coordinates, linearized equations were derived following Newton's method which are solved by the method of conjugate gradients. It is shown that the precalculation of approximate values for the unknown coordinates may be omitted entirely. They can be taken from a map or a rough sketch. Furthermore, with suitable organization of the calculation procedure, neither the normal equations nor the observation equations have to be stored in the core. Practical experience with short computing times has shown that the algorithm is very efficient. It is possible to adjust about 3000 points simultaneously if a storage capacity of 58,000 words is available. For the adjustment of 730 new points - 2800 observations and 5 iterative steps - only 290 CP sec at a CDC 6600 were needed. A remarkable acceleration of the convergence of the method of conjugate gradients was obtained using scaled matrices. The number of iteration steps for the solution was reduced from n/3 to n/5 with n unknowns, while for an unscaled system of equations more than n iteration steps were needed. Author (ESA)

N78-22421 Karlsruhe Univ. (West Germany). Inst. fuer Geodaesie.

NUMERICAL FILTERING OF TRILATERATION NETWORKS **c43**

Heribert Kahmen *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 53-66 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

The autocorrelation functions of the fluctuations of the refractivity for light- and microwaves, and of electronically measured distances, were estimated. Normally it is difficult to estimate the correlation functions of the electronically measured distances since for economic reasons only a small number of repeated measurements can be done. Therefore, an attempt was made to estimate the functions in an indirect way using temperatures registered over a period of years on a tower at different heights. It is shown that with the numerical filtering of trilateration networks two processes of different frequency ranges can occur whose correlation functions superimpose additively. A model of least squares collocation was used for filtering. Author (ESA)

N78-22422 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

AN INVESTIGATION OF THE ZERO-POINT STABILITY OF THE PRESENT WETTZELL LASER RANGING SYSTEM **c36**

Klemens Nottarp *In its* Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 67-69 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

The position and stability of the zero-point of the laser ranging equipment used in Wettzell as a function of different operational parameters was experimentally investigated. The magnitude of the possible uncertainty of the zero-point was derived from the results. Author (ESA)

N78-22423 Technische Universitaet, Munich (West Germany). Sonderforschungsbereich 78 Satellitengeodaesie.

THE ACHIEVEMENTS TO DATE AT THE SATELLITE OBSERVATION STATION IN WETTZELL **c43**

Klemens Nottarp, M. Schneider, H. Seeger, R. Sigl, P. Wilson, and E. Wolf *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 71-85 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

The satellite observation station in Wettzell was put into operation in autumn 1972, with the objective of concentrating satellite observational instruments at a single station. The experience of the group working there in making measurements to satellites had, until then, been restricted to observations using ballistic cameras. Since 1972 operations have been extended from photography and laser ranging to Doppler measurements at the navigation and at the GEOS-frequencies and to C-band-radar. A new laser ranger of very advanced design was to be installed in June 1976 and studies made on future instrumentation such as a laser-Doppler. Experiences to date are summarized and it is shown how the many difficulties experienced in the first years were used to advantage in specifying designs for new instrumentation. Author (ESA)

N78-22424 Karlsruhe Univ. (West Germany). Inst. fuer Geodaesie.

SOME CONSIDERATIONS USING INTERVAL ANALYSIS IN ADJUSTMENT COMPUTATIONS **c64**

Guenter Schmitt *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 87-97 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

The basic definitions of interval analysis are presented. Its application to problems of geodetic error propagation and adjustment computation was studied. It is pointed out that the simple interval arithmetic is unable to take the place of the law of error propagation since the theory of dependent intervals causes solution intervals the spans of which are much too large; but it can bound the solution of geodetic normal equations by iterative algorithms as alternative to mostly too pessimistic rounding error estimations. The problem of the maximal variation of the results dependent on variations of the input data concerning adjustment procedures is a typical problem of interval analysis, which is solved by bounding the solution complex of interval systems. Author (ESA)

N78-22425 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

ON THE ACCURACY OF LONGITUDE DETERMINATIONS USING THE VUGTK-CSSR CIRCUMZENITHAL ASTROLABE **c43**

Gerhard Soltau *In its* Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 99-106 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

The VUGTK-CSSR astrolabe is described and its accuracy considered. The instrument is equipped with an impersonal micrometer for precise observations and was used in 1973 and 1974 for checking connections between points in the Federal Republic of Germany to the world network of longitude stations via the Hamburg and Neuchatel stations. Preliminary results of these observations are presented together with a discussion of the accuracies achieved; they are comparable with longitudes determined using transportable passage instruments such as the Askania AP 70. In addition, the observational techniques are simple and regular and the computation of the results can be fully automated. Author (ESA)

N78-22426 Technische Universitaet, Hanover (West Germany). Inst. fuer Theoretische Geodaesie.

ASTROGEODETIC GEOID DETERMINATION IN THE WESTERN HARZ **c43**

W. Torge, G. Boedecker, and H.-G. Wenzel *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 107-122 refs Sponsored by Deut. Forschungsgemeinschaft (For availability see

N78-22415 13-42)
Avail: NTIS HC A04/MF A01

In the Western Harz (Federal Republic of Germany), geodetic test network, relative geoid determinations were carried out using different terrestrial methods. The aim of this research work was to investigate the possibilities of solving the height problem in three dimensional terrestrial networks of regional extension. The investigations relate to the following topics: Calculation of ellipsoidal heights by geometric-astronomic leveling and comparison with the orthometric heights; calculation of trigonometric heights and comparison with the orthometric heights; geoid calculation by astronomic leveling, using different numbers of astronomical control points; and weight and correlation problems in the adjustment of geoid undulation differences. The accuracy level obtained by the different methods for the ellipsoidal heights and the relative geoid is at the order of a few cm. Author (ESA)

N78-22427 Technische Universitaet, Hanover (West Germany). Inst. fuer Theoretische Geodaesie.
STABILITY OF TEMPERATURE IN A TRANSFORMED ASKANIA GRAVIMETER **c43**
H.-G. Wenzel *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 123-160 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

The stability of temperature in an Askania Gs 12 gravimeter with capacitive sensor was measured with a sensitive thermistor feeler; the internal temperature depends on the room temperature by a factor 1:30 due to the bad regulation of the outer thermostat generally only used. Variations of the room temperature up to 0.1 C cannot be avoided even with regulation of the room temperature; the temperature in the gravimeter varies up to 0.003 C, which produces errors in the reading of 10 micro Gal. To increase measuring accuracy, the stability of internal temperature has to be improved. This can easily be done by using also the inner thermostat of the gravimeter with some necessary modifications, especially concerning damping of the resulting short periodic temperature noise. Author (ESA)

N78-22428 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DOPPLER POINT POSITIONING USING THE N.N.S.S. BROADCAST EPHEMERIS **c04**
Peter Wilson *In its* Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 131-136 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

An assessment of the accuracy of Doppler point positioning with the aid of the Canadian Marconi CMA-722B and the Navy Navigation Satellite System broadcast ephemeris was made. Conclusions were drawn on the strength of the fix and the time required to obtain a specified accuracy. Comparisons were made with solutions computed from data collected on each satellite individually. Author (ESA)

N78-22562# Israeli Program for Scientific Translations Ltd., Jerusalem.
INTRODUCTION TO EFFECTS OF SOLAR ACTIVITY ON THE EARTH'S ATMOSPHERE AND BIOSPHERE
M. N. Gnevyshev *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p v-xiv refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N78-22429 Oklahoma State Univ., Stillwater.
THE TEMPORAL CORRELATIBILITY OF DIGITAL THERMAL INFRARED SCANNER DATA Ph.D. Thesis
Edmund Henry Conrow 1976 210 p
Avail: Univ. Microfilms Order No. 78-01228

The correlatability of thermal patterns obtained by terrain mapping with a scanning radiometer was explored. The NOAA-3 vhrr thermal IR digital data was utilized to determine whether invariant and/or mean-biased consistent thermal features on the earth's surface can be detected. After geometric registration, point-by-point differencing was used in day/day, day/night, and night/night analyses to determine if the correlation between data sets was sufficiently high to warrant further investigation for application to position-location systems. In addition, an investigation was made to determine if observed physical and environmental factors would have an effect on the degree of correlatability between data sets. Dissert. Abstr.

N78-22430 Cornell Univ., Ithaca, N. Y.
STRENGTH OF FIGURE TABLES FOR DESIGN OF HORIZONTAL CONTROL NETWORKS Ph.D. Thesis
Hassan Mohamed Hassan 1977 198 p
Avail: Univ. Microfilms Order No. 78-01630

These tables are functions of the variance-covariance matrix of observation equations. They indicate the expected errors of the unknown stations rather than how well the lengths are carried forward. The tables give all the elements of the expected error ellipses of the unknown points. These elements are: the major and minor axes of the error ellipse and their orientation plus a new strength of figure factor. One major difference between these tables and the conventional strength of figure table is that they can be used for design where both distances and angles are observed. Another added important benefit is that these tables can be used by the field surveyor while he is still in the field. As such, these tables are particularly important and indeed indispensable to surveyors in developing countries where large computers are rare and centralized. Moreover in most developing countries the communication systems are so poor that without such tables the field surveyor is left solely to his experience and judgement. Dissert. Abstr.

N78-22431 Minnesota Univ., Minneapolis.
THE INFLUENCE OF ICE-CRYSTAL SIZE AND DISPERSED-SOLID INCLUSIONS ON THE CREEP OF POLYCRYSTALLINE ICE Ph.D. Thesis
Robert William Baker 1977 111 p
Avail: Univ. Microfilms Order No. 78-02631

The rheological properties of polycrystalline ice containing solid inclusions were investigated using uniaxial-compression test in the laboratory and field measurements on the Barnes Ice Cap at Baffin Island. During freezing, the presence of inclusions in low concentrations inhibits crystal growth; variations in the volume-fraction of inclusions thus result in variations in ice-crystal size. The creep rate of polycrystalline ice at high temperatures and moderate stresses is extremely sensitive to variations in ice-crystals size. Due to an apparent inversion between dislocation-controlled creep and diffusion-controlled creep, the optimum grain size for creep resistance is about 1.0 mm. Increasing or decreasing the average crystals from this critical value results in an increase in secondary-creep rate. Dissert. Abstr.

N78-22432*# New Mexico Univ., Albuquerque. Technology Application Center.
QUARTERLY LITERATURE REVIEW OF THE REMOTE SENSING OF NATURAL RESOURCES Quarterly Report, Oct. - Dec. 1977
Charles B. Fears, ed. and Michael H. Inglis, ed. Dec. 1977 174 p refs Sponsored by NASA
(NASA-CR-156158; RS77-09604; QR-4) Copyright. Avail: NTIS HC A08/MF A01 for foreign requestors only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque CSCL 08F

The Technology Application Center reviewed abstracted literature sources, and selected document data and data gathering techniques which were performed or obtained remotely from space, aircraft or groundbased stations. All of the documentation was related to remote sensing sensors or the remote sensing of the natural resources. Sensors were primarily those operating within the 10 to the minus 8 power to 1 meter wavelength band. Included are NASA Tech Briefs, ARAC Industrial Applica-

tions Reports, U.S. Navy Technical Reports, U.S. Patent reports, and other technical articles and reports. Author

N78-22433 Pennsylvania Univ., Philadelphia.
THE DETECTION OF COLOR BOUNDARIES BY MEANS OF CHROMATIC DISPERSION Ph.D. Thesis
Bruce Watts Bevan 1977 202 p
Avail: Univ. Microfilms Order No. 78-06556

A general technique for detecting the boundaries between objects of different color was developed. It is based on the principle that a color boundary imaged through a color dispersing prism will yield a color spectrum at the boundary which measures the difference between the two colors. Therefore, this colored band both indicates the presence of a boundary between different colors and also quantifies or records the difference between the colors. This colored band will be recorded as light or dark banding on a spectrum-integrating imager, such as a camera with black and white film, so that a color boundary will be detectable even though the two colors yield the same photographic gray density on the film. Dissert. Abstr.

N78-22434 General Electric Co., Philadelphia, Pa.
IMAGE PROCESSING INVESTIGATIONS
G. J. Chafaris, F. Alyea, D. L. Dietrich, and J. Birkemeier 21 Dec. 1977 189 p refs
(IR/D Proj. 14RO-DT1-400)
(DOC-77SDB002) Avail: GE Space and RESD Libraries, P.O. Box 8555, Phila., Pa. 19101; Attn: Larry Chasen, Mgr., Rm. L-1343 HC $17.50

Four investigations aimed at improving LANDSAT image/data processing and analysis techniques are described. These are: (1) an investigation of the effects of radiometric compression/decompression on LANDSAT data; (2) an investigation of the advantages/disadvantages of maximum likelihood classification of LANDSAT data; (3) an investigation of the sensitivity of thematic mapper measurements to atmospheric parameters and (4) an investigation that developed a convolution matrix processor that improves GE IMAGE 100 operations. Author

N78-22435*# Geological Survey, Denver, Colo.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES USING THE LANDSAT-1 DATA COLLECTION SYSTEM. PART 3: HEAT DISCHARGE FROM MOUNT ST. HELENS, WASHINGTON Final Report, 1972 - 1975
Jules D. Friedman and David Frank, Principal Investigators May 1977 34 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E78-10122; NASA-CR-156972) Avail: NTIS HC A03/MF A01 CSCL 08K

The author has identified the following significant results. Two thermal anomalies, A at 2740 m altitude on the north slope, and B between 2650 and 2750 m altitude on the southwest slope at the contact of the dacite summit dome of Mount St. Helens, Washington were confirmed by aerial infrared scanner surveys between 1971 and 1973. LANDSAT 1 data collection platform 6166, emplaced at site B anomaly, transmitted 482 sets of temperature values in 1973 and 1974, suitable for estimating the differential radiant emission as 84 W/sq m, approximately equivalent to the Fourier conductive flux of 89 W/sq m in the upper 15 cm below the surface. The differential geothermal flux, including heat loss via evaporation and convection, was estimated at 376 W/sq m. Total energy yield of Mount St. Helens probably ranges between 0.1 and 0.4 x 10 to the 6th power W.

N78-22436*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISTRIBUTED-SWITCH DICKE RADIOMETER Patent Application
Curt A. Levis, inventor (to NASA) (Ohio State Univ., Columbus) Filed 29 Mar. 1978 19 p Sponsored by NASA
(NASA-Case-GSC-12219-1; US-Patent-Appl-SN-891356) Avail: NTIS HC A02/MF A01 CSCL 14B

A radiometer was designed with an array of transducers which simultaneously feed a number of processing channels that are periodically connected to be responsive to noise sources at a predetermined noise temperature. The noise sources are utilized to control the gain of the processing channels to enable each processing channel to derive an output that is an accurate replica of the amplitude and phase of the radiometric signal supplied to it. The array of antenna elements or subapertures transduces electromagnetic energy from a terrestrial or atmospheric region being monitored into electric signals. Output signals from each channel, indicative of radiation from the region being monitored, are combined in a beam former that derives one or more signals that are replicas of the radiant energy from subregions of the total region being monitored. The signals derived from the beam former are amplitude detected to derive the required information. NASA

N78-22437*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GENERATION AND PHYSICAL CHARACTERISTICS OF THE LANDSAT-1, -2 AND -3 MSS COMPUTER COMPATIBLE TAPES
Valerie L. Thomas Dec. 1977 83 p Revised
(NASA-TM-78018; X-563-75-223-Rev) Avail: NTIS HC A05/MF A01 CSCL 05B

The generation and format of the LANDSAT 1, 2, and 3 system corrected multispectral scanner computer compatible tapes are discussed. Included in the discussion are the spacecraft sensors, scene characteristics, the transmission of data, and the conversion of the data to computer compatible tapes. Also included in the discussion are geometric and radiometric corrections, tape formats, and the physical characteristics of the tape. Author

N78-22438*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HAND-HELD RADIOMETER RED AND PHOTOGRAPHIC INFRARED SPECTRAL MEASUREMENTS OF AGRICULTURAL CROPS
Compton J. Tucker, Cheng-jin Fan (Morgan State Univ.), James H. Elgin, Jr. (Dept. of Agr., Beltsville, Md.), and James E. McMurtrey (Dept. of Agr., Beltsville, Md.) Feb. 1978 25 p refs Submitted for publication
(NASA-TM-78091) Avail: NTIS HC A02/MF A01 CSCL 02C

Red and photographic infrared radiance data, collected under a variety of conditions at weekly intervals throughout the growing season using a hand-held radiometer, were used to monitor crop growth and development. The vegetation index transformation was used to effectively compensate for the different irradiational conditions encountered during the study period. These data, plotted against time, compared the different crops measured by comparing their green leaf biomass dynamics. This approach, based entirely upon spectral inputs, closely monitors crop growth and development and indicates the promise of ground-based hand-held radiometer measurements of crops. Author

N78-22439# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve Office.
STRATEGIC PETROLEUM RESERVE: FINAL ENVIRONMENTAL IMPACT STATEMENT FOR KLEER MINE
Sep. 1977 598 p refs
(FES-77-2; FEA/S-77/324) Avail: NTIS HC A25/MF A01

This site-specific Environmental Impact Statement has identified particularly sensitive environmental parameters for the Kleer Mine, Texas Early Storage site. The most sensitive parameters to be affected by oil storage development appear to be water quality, air quality, and socioeconomic factors. The significant adverse impacts to the physical environment that could result from the program include: degradation of surface water quality due to sedimentation from runoff and erosion during pipeline construction activities; a moderate increase in hydrocarbon emissions during transfer and temporary storage of oil in the Winnsboro storage tanks; locally significant increases in hydrocarbon emissions during transport of oil from the Gulf of Mexico to Winnsboro Terminal; and the potential for an increase in the frequency of oil spills along the transportation corridors. Changes in water quality would have a short term impact on the aquatic organisms. Author

N78-22440*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
DESIGN OF EXPERIMENT FOR EARTH ROTATION AND

BASELINE PARAMETER DETERMINATION FROM VERY LONG BASELINE INTERFEROMETRY
Athanasios Dermanis Feb. 1977 123 p refs
(Grant NGR-36-008-204; OSURF Proj. 783820)
(NASA-CR-156970; Rept-245) Avail: NTIS HC A06/MF A01 CSCL 08F

The possibility of recovering earth rotation and network geometry (baseline) parameters are emphasized. The numerical simulated experiments performed are set up in an environment where station coordinates vary with respect to inertial space according to a simulated earth rotation model similar to the actual but unknown rotation of the earth. The basic technique of VLBI and its matematical model are presented. The parametrization of earth rotation chosen is described and the resulting model is linearized. A simple analysis of the geometry of the observations leads to some useful hints on achieving maximum sensitivity of the observations with respect to the parameters considered. The basic philosophy for the simulation of data and their analysis through standard least squares adjustment techniques is presented. A number of characteristic network designs based on present and candidate station locations are chosen. The results of the simulations for each design are presented together with a summary of the conclusions. Author

N78-22441*# General Electric Co., Philadelphia, Pa. LANDSAT Operations Control Center.
LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT, 23 JANUARY - 23 APRIL 1977
23 May 1977 217 p refs
(Contract NAS5-21808)
(NASA-CR-156750; DOC-77SDS4228) Avail: NTIS HC A10/MF A01 CSCL 05B

The LANDSAT operations from launch through orbital instrument observations are reviewed. Orbital parameters, power subsystem, attitude control subsystem, and command/clock subsystem are discussed. Other subsystems are also considered, such as telemetry, orbit adjust, electrical interface, thermal, wideband telemetry, multispectral scanner, and data collection. J.A.M.

N78-22442*# Old Dominion Univ., Norfolk, Va. School of Engineering.
LABORATORY REQUIREMENTS FOR IN-SITU AND REMOTE SENSING OF SUSPENDED MATERIAL Final Report
Chin Y. Kuo and Robert Y. K. Cheng Mar. 1978 90 p refs
(Contract NAS1-11707)
(NASA-CR-145367; TR-76-C2) Avail: NTIS HC A05/MF A01 CSCL 08H

Recommendations for laboratory and in-situ measurements required for remote sensing of suspended material are presented. This study investigates the properties of the suspended materials, factors influencing the upwelling radiance, and the various types of remote sensing techniques. Calibration and correlation procedures are given to obtain the accuracy necessary to quantify the suspended materials by remote sensing. In addition, the report presents a survey of the national need for sediment data, the agencies that deal with and require the data of suspended sediment, and a summary of some recent findings of sediment measurements. Author

N78-22443# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
SYSTEMATIC IMAGE ERRORS [SYSTEMATISCHE BILDFEHLER]
Bayerische Akad. der Wiss. 1977 70 p refs In GERMAN Proc. of a Photogrammetry Conf. held at Bonn, 5 Dec. 1975 (Ser-B-226; ISBN-3-7696-8528-8) Avail: NTIS HC A04/MF A01

Papers are presented concerning adjustment of systematic errors in photogrammetry. The compensation of systematic image errors by photoflight dispositions, together with bundle adjustment, is discussed. Partial calibration based on a test field is reviewed. A simultaneous block adjustment method with self-calibration is outlined. Computer techniques are discussed for extensive image associations using the bundle method. Results of photogrammetric fixed point determination are presented. For individual titles, see N78-22444 through N78-22448.

N78-22444# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
COMPENSATION OF SYSTEMATIC IMAGE ERRORS BY PHOTOFLIGHT DISPOSITIONS? [KOMPENSATION SYSTEMATISCHER BILDFEHLER DURCH DIE BILDFLUGANORDNUNG?]
Joachim Thomas *In its* Systematic Image Errors 1977 p 12-22 refs Partly in GERMAN and ENGLISH (For availability see N78-22443 13-43)
Copyright. Avail: NTIS HC A04/MF A01

The question is being considered of whether a compensation of systematic image errors is to be reached by manifold flying and subsequent simultaneous bundle adjustment. Fundamental connections between types of systematic image errors and optimal compensating flight dispositions were found based on extensive empirical investigations. The resulting compensation can be reduced to the arithmetic mean (of all photooverlaps) of the systematic errors in the image plane. A graphical and an algebraic method were developed to determine the average of two-dimensional errors in a two-dimensional distribution. Partly new flight dispositions for compensation of systematic image errors were conceived based on both methods. Author (ESA)

N78-22445# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
PARTIAL CALIBRATION OF A PHOTOGRAMMETRY SYSTEM USING TEST FIELDS [TEILKALIBRIERUNG EINES PHOTOGRAMMETRISCHEN SYSTEMS UNTER VERWENDUNG VON TESTFELDERN]
L. Mauelshagen *In its* Systematic Image Errors 1977 p 23-38 refs In GERMAN (For availability see N78-22443 13-43)
Copyright. Avail: NTIS HC A04/MF A01

Partial calibration based on a test field is discussed as a method for the treatment of the systematic image errors in photogrammetry. The mathematical model determining the photogrammetric mapping by the projection relations between measured image and photographic object is described. Practical results of partial calibrations are outlined. These show that considerable accuracy improvements in block adjustment may be expected as a result of the elimination of systematic image errors. ESA

N78-22446# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
BLOCK ADJUSTMENT WITH SELF CALIBRATION [BLOCKAUSGLEICHUNG MIT SELBSTKALIBRIERUNG]
H. Ebner *In its* Systematic Image Errors 1977 p 39-54 refs In GERMAN (For availability see N78-22443 13-43)
Copyright. Avail: NTIS HC A04/MF A01

A block adjustment method with self-calibration is described for photogrammetry. The method is simultaneous in that the systematic image or model deformations are compensated by additional parameters of the adjustment. A strategy is proposed based on a sufficiently general functional and stochastic model, and on suitable statistical tests, with which the significance of calculated correction terms is rigidly tested. A certain standardization of the method is aimed at. Practical test results of bundle block adjustments and of block adjustments with independent models are described, which demonstrate the performance of the proposed simultaneous self-calibration strategy. ESA

N78-22447# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
CONCEPT FOR THE CALCULATION OF EXTENSIVE IMAGE ASSOCIATIONS USING THE BUNDLE METHOD [KONZEPT ZUR BERECHNUNG GROSSER BILDVERBAENDE MIT HILFE DER BUENDELMETHODE]
Juergen Mueller *In its* Systematic Image Errors 1977 p 55-65 In GERMAN (For availability see N78-22443 13-43)
Copyright. Avail: NTIS HC A04/MF A01

A computer program system is proposed for calculation of extensive image associations in photogrammetry using the bundle method. The capabilities of data processing for block triangulation are demonstrated. A modular approach to the development of the system is discussed in which first the central functions are established (construction of image file, file management), and then the attached separate processing programs. ESA

N78-22448# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
FIRST RESULTS OF PHOTOGRAMMETRIC FIXED POINT CONCENTRATION HORDORF [ERSTE ERGEBNISSE DER PHOTOGRAMMETRISCHEN FESTPUNKTVERDICHTUNG HORDORF]
W. Tegeler *In its* Systematic Image Errors 1977 p 66-70 refs In GERMAN (For availability see N78-22443 13-43)
Copyright. Avail: NTIS HC A04/MF A01

The trigonometric points of third and fourth order, all reference points, and the height points were determined using photogrammetry for a test area of 6 km by 12 km. Photoflights were carried out with two different cameras. Block adjustment took place by using the bundle method. Results are presented. ESA

N78-22449# Weapons Research Establishment, Salisbury (Australia).
BICUBIC SPLINE INTERPOLATION FROM DATA IN CONTOUR FORM
D. A. B. Fogg Aug. 1977 46 p refs
(AD-A050821; WRE-TR-1837(A); AR-000-596) Avail: NTIS HC A03/MF A01 CSCL 14/2

A method is developed for converting contour data to lattice-point data, to which a bicubic spline surface can be fitted. Author (GRA)

N78-22450# Control Data Corp., Minneapolis, Minn. Digital Image Systems Div.
IMAGE COMPRESSION TECHNIQUES Final Technical Report, 30 Jun. 1977 - 30 Jun. 1978
A. E. Labonte and C. J. McCallum Dec. 1977 104 p refs
(Contract F30602-76-C-0350)
(AD-A050679; RADC-TR-77-405) Avail: NTIS HC A06/MF A01 CSCL 14/5

Timely transmission of large format digital imagery over narrow bandwidth lines requires efficient and high compression of the digitized images. The techniques developed, Micro-Adaptive Picture Sequencing (MAPS), are a two-dimensional, spatial adaptive technique which uses the Redundant Area Coding (REARC) concept along with a very versatile algorithm developed by Control Data Corporation. Compression ratios of 30:1 have been achieved with MSE ranging from .548 to 2.534 percent for a broad variety of visible and radar imagery. Author (GRA)

N78-22451# Cornell Univ., Ithaca, N. Y. Dept. of Agricultural Economics.
ENHANCED OIL RECOVERY: THE IMPACT OF POLICY OPTIONS
Robert J. Kalter Jul. 1977 30 p refs
(Grant NSF SIA-74-21846)
(PB-276763/0; STAFF-PAPER-77-27; NSF/RA-770324) Avail: NTIS HC A03/MF A01 CSCL 10A

Enhanced recovery processes are evaluated under the assumption of information certainty, using forecasts of production, price and cost profiles for selected reservoirs. Alternative public policy options, designed to foster private sector development, are evaluated under this assumption. A second analysis, using subjective probability distribution of key input variables, is conducted in an effort to ascertain the impact of these and other policy alternatives designed for situations of uncertainty. The following potential public policy actions are analyzed and evaluated: (1) alternative regulated and/or market price levels; (2) price and/or purchase guarantees for enchanced oil production over the lifetime of a producing facility and (3) alternative taxation policies. GRA

N78-22452# Office of Technology Assessment, Washington, D. C.
ENHANCED OIL RECOVERY POTENTIAL IN THE UNITED STATES
Jan. 1978 232 p
(PB-276594/9; OTA-E-59; LC-77-600063) Avail: NTIS HC A11/MF A01 CSCL 08I

The potential for increasing domestic production from known reservoirs using enhanced oil recovery (EOR) techniques is discussed. The study examines five EOR processes, including in situ combustion, steam injection, and flooding. The report discusses the economic, environmental, and legal impacts of enhanced oil recovery, and includes appendices on the oil resource and supporting materials for enhanced oil recovery projections, as well as additional information on the legal aspects of EOR. GRA

N78-22453# Alaska Univ., Fairbanks.
SUSPENDED SEDIMENTS AND RELATED LIMNOLOGY OF AN ALPINE LAKE SYSTEM Year End Report, 1 Jun. 1976 - 31 Jan. 1977
V. Alexander, J. Mellor, and R. J. Barsdate 31 Jan. 1977 16 p
(Contract EY-76-S-06-2229-010)
(RLO/2229/T10-2; AR-2) Avail: NTIS HC A02/MF A01

This project has the aim of first assessing the potential of remote sensing to determine changes in sediment load in arctic lakes, and then to use this technique to assess the effects of road construction on arctic freshwater aquatic habitats. The first part of the work has centered on the use of Peters and Schraeder Lakes as a natural laboratory since these lakes have a strong sediment gradient for methodology evaluation. The next stage is to expand this work to other lakes and finally to actually look at the impact of changes in sediment load due to construction activities and utilization of arctic road systems. The results of the fi st two years' work suggest that the method has value, and the project is now ready to approach the terminal phase in looking at the real effects of road construction in the arctic. VP-8 density slicing and densitometry of the films are the two analysis techniques in use, with Plus-X Aerographic film in an aerial mapping camera format the film of choice. Ground truth data were collected in conjunction with the aerial mapping data, and some information on the effects of sediment load on primary production regimes was also included. ERA

N78-22454*# Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
ASSESSMENT OF AQUATIC VEGETATION WITH SATELLITE-DERIVED DATA Technical Completion Report, Jun. - Sep. 1977
B. L. Markham, W. R. Philipson, J. Ng, and T. Liang Nov. 1977 24 p refs
(Grant NGL-33-010-171; Contract DI-14-34-0001-7068; OWRT Proj. A-082-NY(1))
(NASA-CR-156295; PB-275768/0; W78-02401) Avail: NTIS HC A02/MF A01 CSCL 08H

LANDSAT satellite data were analyzed manually and digitally to determine whether they can provide any useful information concerning freshwater, aquatic vegetation. The study focused on central New York State, where aerial photographic coverage and field data for three lakes were available for comparison. GRA

N78-22455# Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
FORESTED WETLANDS FOR WATER RESOURCE MANAGEMENT IN SOUTHERN ILLINOIS Final Report
William J. Mitsch, Carol L. Dorge, and John R. Wiemhoff Nov. 1977 281 p refs Prepared in cooperation with Illinois Univ. at Urbana-Champaign
(Contract DI-14-31-0001-7030)
(PB-276659/0; UILU-WRC-77-0132; W78-03423; OWRT-A-088-Ill(1)) Avail: NTIS HC A13/MF A01 CSCL 13B

A 30 ha cypress - tupelo floodplain swamp in Southern Illinois was studied for its hydrologic, biogeochemical and ecological characteristics. The hydrology, water chemistry, sediment dynamics and ecosystem productivity were described for the swamp and interactions with the adjacent Cache River were emphasized. The annual hydrology budget for the swamp showed inflows of 74.4 cm throughfall, 63.9 cm runoff, and 21.9 cm groundwater; the outflows were 72.8 cm evapotranspiration, 54.9 cm surface outflow, and 21.0 cm groundwater, the latter two draining to the river. Loading rates for several chemical parameters were calculated from the swamp to the river and water chemistry of the swamp and river was contrasted. Primary productivity measurements showed high rates when the floating duckweed was included; cypress productivity was shown historically to be related to amount of flooding. A phosphorus budget was determined for the swamp and this indicated that

the flooding river contributed over 10 times the phosphorus to the swamp as was discharged the rest of the year. GRA

N78-22456# National Geodetic Survey, Rockville, Md.
ESTABLISHMENT OF CALIBRATION BASE LINES
Joseph F. Dracup Aug. 1977 29 p refs
(PB-277130/1; NOAA-77122102; NOAA-TM-NOS-NSG-8)
Avail: NTIS HC A03/MF A01 CSCL 08E

The calibration of electronic distance measuring instruments involves the determination or verification of instrument constants and the assurance that the measured distances meet accuracy specifications. The verification effort is reduced when an accurately measured distance can be used. However, to assure that an instrument is measuring properly, a known distance of high accuracy, or preferably, a sequence of distances forming a calibration range or base line is required. Specifications and recommendations on the establishment of calibration base lines are described in some detail. GRA

N78-22457# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: 19-ORGAN PIPE CACTUS NATIONAL MONUMENT
Janet M. Bonner 1977 76 p
(PB-276550/1) Avail: NTIS HC A05/MF A01 CSCL 08B

Each data report in this series lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

N78-22414# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE GEOCHEMISTRY OF AQUEOUS MIGRANTS, PART 3
In its Geochem. of Elem. in the Supergene Zone 1977 p 97-246 refs (For availability see N78-22411 13-42)
Copyright. Avail: NTIS HC A12/MF A01

N78-22418 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
SMOOTHING OF LAPLACE DISCREPANCIES
Dieter Ehlert *In its* Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 21-26 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-22419 Bayerische Akademie der Wissenschaften, Munich (West Germany). Bayerische Kommission fuer die Internationale Erdmessung.
GEOMETRIC ADJUSTMENT OF WESTERN EUROPEAN SATELLITE TRIANGULATION (SOLUTION 1975)
Walter Ehrnsperger *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 27-42 refs Sponsored by Deut. Forschungsgemeinschaft (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-22420 Stuttgart Univ. (West Germany). Inst. fuer Anwendungen der Geodaesie im Bauwesen.
A RIGOROUS NON-LINEAR LEAST SQUARE ADJUSTMENT OF EXTENSIVE GEODETIC NETWORKS
L. Gruendig and K. Linkwitz *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 43-51 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-22421 Karlsruhe Univ. (West Germany). Inst. fuer Geodaesie.
NUMERICAL FILTERING OF TRILATERATION NETWORKS
Heribert Kahmen *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 53-66 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-22423 Technische Universitaet, Munich (West Germany). Sonderforschungsbereich 78 Satellitengeodaesie.
THE ACHIEVEMENTS TO DATE AT THE SATELLITE OBSERVATION STATION IN WETTZELL
Klemens Nottarp, M. Schneider, H. Seeger, R. Sigl, P. Wilson, and E. Wolf *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 71-85 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-22425 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON THE ACCURACY OF LONGITUDE DETERMINATIONS USING THE VUGTK-CSSR CIRCUMZENITHAL ASTROLABE
Gerhard Soltau *In its* Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 99-106 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-22426 Technische Universitaet, Hanover (West Germany). Inst. fuer Theoretische Geodaesie.
ASTROGEODETIC GEOID DETERMINATION IN THE WESTERN HARZ
W. Torge, G. Boedecker, and H.-G. Wenzel *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 107-122 refs Sponsored by Deut. Forschungsgemeinschaft (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-22427 Technische Universitaet, Hanover (West Germany). Inst. fuer Theoretische Geodaesie.
STABILITY OF TEMPERATURE IN A TRANSFORMED ASKANIA GRAVIMETER
H.-G. Wenzel *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 123-160 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-22565# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE RELATIONSHIP BETWEEN SOLAR ACTIVITY, CLIMATE, AND THE GROWTH OF TREE STANDS
T. T. Bitvinskas *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 53-57 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauk Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-22458 Pittsburgh Univ., Pa.
DEVELOPMENT OF A Ti/Fe REDOX COUPLE FLOW BATTERY SYSTEM Ph.D. Thesis
Robert Francis Savinell 1977 243 p
Avail: Univ. Microfilms Order No. 78-01888

A flow redox cell with graphite foil electrodes and an anion permeable membrane separator were designed, constructed and

operated. The Fe/Ti redox couple reaction was employed. Both the flow cell and a stationary cell were used to evaluate the limiting factors of this battery system. The effects of polarizations on the cell performance were investigated. These polarizations included those from diffusion, activation and internal resistance. It was found that this battery system was not diffusion controlled and was greatly affected by activation. The activation influence was attributed to the oxidation reaction of titanous chloride. The internal resistance polarization was more dominant for cells with large electrode surface area. The application of a pulsating flow to the flow battery system did not affect or improve the battery performance. However, the use of different electrode material showed a marked difference in the performance of the stationary cell. Dissert. Abstr.

N78-22459*+ National Aeronautics and Space Administration, Washington, D. C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 15
Oct. 1977 582 p refs
(NASA-SP-7043(15)) Avail: NTIS HC E05 CSCL 10B

This bibliography lists 1112 reports, articles, and other documents introduced into the NASA scientific and technical information system from July 1, 1977 through September 30, 1977. Author

N78-22460 Wayne State Univ., Detroit, Mich.
PROPERTIES OF TIN OXIDE HETEROJUNCTION SOLAR CELLS Ph.D. Thesis
Ronald Norman Legge 1977 129 p
Avail: Univ. Microfilms Order No. 78-05197

Chemical vapor deposition techniques were developed to form transparent, conducting thin films of SnO2 on single crystal semiconductor substrates. The electrical and optical properties of these heterojunction devices were studied in detail. Devices fabricated from n-Ge, n-Si, and n-GaAs show good photovoltaic properties. A model is presented to account for the unusual characteristics of these devices. In addition, the advantages and disadvantages of these devices over conventional solar cells are discussed. Dissert. Abstr.

N78-22461 Wayne State Univ., Detroit, Mich.
THE EFFECTS OF IMPURITY CONCENTRATION ON THE PROPERTIES OF HOMOJUNCTION AND HETEROJUNCTION SOLAR CELLS Ph.D. Thesis
Lan Hsu 1977 123 p
Avail: Univ. Microfilms Order No. 78-05189

Effects of impurity concentration on the properties of silicon homojunction and In2O3/Si,/Ge,/GaAs,/InP heterojunction solar cells were investigated both experimentally and theoretically. For the homojunction, based on the continuity equation, it was shown that both the built-in electric field gradient and the mobility gradient in the diffused region of a silicon solar cell act as effective recombination processes for the minority carrier. The short-circuit current contribution of n+-diffused, of depletion, and of the base region for various impurity profiles and base resistivities were calculated. Impurity concentration in the diffused region was profiled by four point probe differential Hall and resistivity measurement. The theoretical short circuit current was compared with measured values as a function of wavelength and found to be in resonably good agreement. Dissert. Abstr.

N78-22462 Iowa State Univ. of Science and Technology, Ames.
EFFECTS OF LARGE INTERCONNECTED WIND GENERATORS ON THE ELECTRIC POWER SYSTEM Ph.D. Thesis
David Kelly Pantalone 1977 135 p
Avail: Univ. Microfilms Order No. 78-05966

When one considers the direct interfacing of wind generator systems (WGSs) with the electric power system, there is an interest in WGS dynamics and compatability with the power system. Two general effects that may occur as a result of the presence of many large WGSs in the system were considered. The first effect deals with the possibility of contributing to dynamic instability in the large interconnected power system. A modal analysis of a set of WGSs on a radial line was used to examine this possibility. The effect of certain components, parameters, and conditions on the eigenvalues was studied. The second effect deals with a load tracking constraint in automatic generation control as affected by the power spectrum of the wind. A frequency response analysis was used to determine the frequency content of the WGS output. Dissert. Abstr.

N78-22463*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HISTORICAL EVIDENCE OF IMPORTANCE TO THE INDUSTRIALIZATION OF FLAT-PLATE SILICON PHOTOVOLTAIC SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY
Jeffrey L. Smith Apr. 1978 14 p refs Prepared for DOE
(Contract NAS7-100)
(NASA-CR-156298; DOE/JPL-1012-78/1-Vol-1; JPL-Pub-78-36-Vol-1; Rept-5101-54-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 10A

An analysis is given of the Low-Cost Silicon Solar Array Project plans for the industrialization of new production technologies expected to be forthcoming as a result of the project's technology development efforts. In particular, LSSA's mandate to insure an annual production capability of 500 MW peak for the photovoltaic supply industry by 1986 is critically examined. The examination focuses on one of the concerns behind this goal -- timely development of industrial capacity to supply anticipated demand. Some of the conclusions include: (1) construction of small-scale pilot plants should be undertaken only for purposes of technology development; (2) large-scale demonstrations should be undertaken only when the technology is well in hand; (3) commercial-scale production should be left to the private sector; (4) the 500-MW annual output goal should be shifted to Program Headquarters. Author

N78-22464*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HISTORICAL EVIDENCE OF IMPORTANCE TO THE INDUSTRIALIZATION OF FLAT-PLATE SILICON PHOTOVOLTAIC SYSTEMS, VOLUME 2
Jeffrey L. Smith, William R. Gates, and Tom Lee Apr. 1978 67 p refs Sponsored by NASA Prepared for JPL
(NASA-CR-156185; DOE/JPL-1012-78/1-Vol-2; JPL-Pub-78-36-Vol-2; Rept-5104-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 10A

Problems which may arise as the low cost silicon solar array (LSSA) project attempts to industrialize the production technologies are defined. The charge to insure an annual production capability of 500 MW peak for the photovoltaic supply industry by 1986 was critically examined, and focused on one of the motivations behind this goal-concern over the timely development of industrial capacity to supply anticipated demand. Conclusions from the analysis are utilized in a discussion of LSSA's industrialization plans, particularly the plans for pilot, demonstration and commercial scale production plants. Specific recommendations for the implementation of an industrialization task and the disposition of the project quantity goal were derived. Author

N78-22465*# IBM Federal Systems Div., Huntsville, Ala.
SYSTEM DESIGN PACKAGE FOR SIMS PROTOTYPE SYSTEM 2, SOLAR HOT WATER
Dec. 1977 112 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150521) Avail: NTIS HC A06/MF A01 CSCL 10A

Information necessary to evaluate the design and assembly of a solar hot water system is presented. A prototype system designed for use in a single family dwelling is investigated in terms of the following subsystems: collector, storage, energy transport, and control. M.V.

N78-22466*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
INDOOR THERMAL PERFORMANCE EVALUATION OF THE SEPCO AIR COLLECTOR
Sep. 1977 35 p Revised Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150631; TR-531-11-Rev-B) Avail: NTIS HC A03/MF A01 CSCL 10A

The procedures used and the results obtained during the evaluation test program on the Solaron solar air collector, model EF-212, under simulated conditions for comparison with data collected in outdoor tests on the same collector are given. The test article was a single glazed collector with a nonsensitive

absorber plate, aluminum box frame, and one inch isocyanurate foam insulation. Author

N78-22467*# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
SOLAR HEATING AND COOLING SYSTEM DESIGN AND DEVELOPMENT Quarterly Report, 1 Oct. - 31 Dec. 1977
10 Mar. 1978 9 p Prepared for DOE
(Contract NAS8-32093)
(NASA-CR-150640; F3437-QR-108) Avail: NTIS HC A02/MF A01 CSCL 10A

The progress of the program during the sixth program quarter is reported. The program calls for the development and delivery of eight prototype solar heating and cooling systems for installation and operational test. The William O'Brien single-family heating system was installed and is operational. The New Castle single-family heating residence is under construction. The Kansas University (KU) system is in the final design stages. The 25 ton cooling subsystem for KU is the debugging stage. Pressure drops that were greater than anticipated were encountered. The 3 ton simulation work is being finalized and the design parameters for the Rankine system were determined from simulation output. Author

N78-22468*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
KINE-PAK: A SELF-CONTAINED, ELECTRICAL POWER GENERATOR SYSTEM Patent Application
David C. Grana and Richard T. Wilem, inventors (to NASA) Filed 3 Mar. 1978 9 p
(NASA-Case-LAR-11551-1; US-Patent-Appl-SN-883090) Avail: NTIS HC A02/MF A01 CSCL 10A

A self contained electrical generator which is powered by random environmental movement such as wave action is described. The self contained generator is used in a buoy, or other devices, to generate electrical power to operate test equipment or weather observation equipment and eliminate or reduce the replacement rate of batteries. The generator is comprised of a rotor, a stator, a helical spring, and a housing. The rotor is rotated relative to the stator and electrical current is generated as the armature winding cuts the lines of magnetic force. The current is supplied to batteries or instruments. NASA

N78-22469*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WIND WHEEL ELECTRIC POWER GENERATOR Patent Application
John W. Kaufman, inventor (to NASA) Filed 24 Feb. 1978 16 p
(NASA-Case-MFS-23515-1; US-Patent-Appl-SN-880726) Avail: NTIS HC A02/MF A01 CSCL 10A

An electric generator driven by the wind is described. Primary and auxiliary funnel-type, venturi ducts are mounted upon a housing for capturing wind currents and conducting the currents to a bladed wheel connected to generator apparatus. Additional air flows are also conducted onto the bladed wheel, rotating the wheel. The auxiliary ducts are disposed at an acute angle with respect to the longitudinal axis of the housing, and together with the rotatability of the housing and the ducts, permits capture of wind currents within a variable directional range. NASA

N78-22470*# National Aeronautics and Space Administration. Pasadena Office, Calif.
DOUBLE-SIDED SOLAR CELL PACKAGE Patent Application
Benjamin Shelpuk, inventor (to NASA) (JPL) Filed 29 Mar. 1978 17 p
(Contract NAS7-100)
(NASA-Case-NPO-14199-1; NASA-Case-NPO-14200-1; US-Patent-Appl-SN-891243) Avail: NTIS HC A02/MF A01 CSCL 10A

A solar cell array for terrestrial use is described. The solar cell package consists of a double sided photovoltaic cell having a metallized P contact and N contact provided on opposite faces of the cell; a transparent tubular body forming a transparent enclosure for the cell; a supporting pedestal formed of conductive metallic material electrically connected with the cell; and a reflector having a surface disposed in substantially opposed relation with one face of the cell for redirecting light to impinge thereon whereby the cell is subjected to incident radiation at each of the opposite faces thereof. By employing the double sided solar cell supported by a pedestal forming a path for heat and electrical currents, the overall efficiency of the array was enhanced. NASA

N78-22471*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME PROPERTIES OF LOW-VAPOR-PRESSURE BRAZE ALLOYS FOR THERMIONIC CONVERTERS
Virginia Bair 1978 14 p refs Presented at the Intern. Plasma Sci. Conf., Monterey, Calif.; sponsored by IEEE
(NASA-TM-78867; E-9598) Avail: NTIS HC A02/MF A01 CSCL 10A

Property measurements were made for arc-melted, rod-shaped specimens. Density and dc electrical resistivity at 296 K were measured for various binary eutectic alloys. Thermal conductivity was inferred from the electrical conductivity using the Wiedemann, Franz, Lorenz relation. Linear thermal expansion from 293 K to two-thirds melting point, under a helium atmosphere, was measured for Zr, 21.7-wt percent Ru; Zr, 13-wt percent W; Zr, 22.3-wt percent Nb; Nb, 66.9-wt percent Ru; and Zr, 25.7-wt percent Ta. Author

N78-22472*# CALMAC Mfg. Co., Englewood, N. J.
PRELIMINARY DESIGN PACKAGE FOR SOLAR COLLECTOR AND SOLAR PUMP
Apr. 1978 41 p Prepared for DOE
(Contract NAS8-32253)
(NASA-CR-150630) Avail: NTIS HC A03/MF A01 CSCL 10A

A solar-operated pump using an existing solar collector, for use on solar heating and cooling and hot water systems is described. Preliminary design criteria of the collector and solar-powered pump is given including: design drawings, verification plans, and hazard analysis. Author

N78-22473*# Sigma Research, Inc., Richland, Wash.
PRELIMINARY DESIGN PACKAGE FOR MAXI-THERM HEAT EXCHANGER MODULE
Apr. 1978 30 p refs Prepared for DOE
(Contract NAS8-32260)
(NASA-CR-150620) Avail: NTIS HC A03/MF A01 CSCL 10A

Heat exchangers were developed for use in a solar heating and cooling system installed in a single family dwelling. Each of the three exchangers consisted of a heating and cooling module and a submersed electric water heating element. Information necessary to evaluate the preliminary design of the heat exchanger is presented in terms of the development and verification plans, performance specifications, installation and maintenance, and hazard analysis. Author

N78-22474*# IBM Federal Systems Div., Huntsville, Ala.
INSTALLATION PACKAGE FOR SIMS PROTOTYPE SYSTEM 2, SOLAR HOT WATER
Jan. 1978 22 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150639) Avail: NTIS HC A02/MF A01 CSCL 10A

The prototype system 2 solar hot water was designed for use in a single family dwelling and consists of the following subsystems: collector, storage, energy transport, and control. Guidelines are presented for utilization in the development of detailed installation plans and specifications. Instruction on operation, maintenance, and repair of the system is discussed. Author

N78-22475*# Owens-Illinois, Inc., Toledo, Ohio.
AIR-LIQUID SOLAR COLLECTOR FOR SOLAR HEATING, COMBINED HEATING AND COOLING, AND HOT WATER SUBSYSTEMS Contractor Report, 1 Nov. 1976 - 31 Oct. 1977
Mar. 1978 79 p refs Prepared for DOE
(Contract NAS8-32259)
(NASA-CR-150569) Avail: NTIS HC A05/MF A01 CSCL 10A

A collection of quarterly reports consisting of the installation

and layout design of the air collector system for commercial applications, completion of the preliminary design review, detailed design efforts, and preparation of the verification test plan are given. Performance specifications and performance testing of a prototype model of a two manifold, 144 tube air collector array is presented. Author

N78-22476# American Univ., Washington, D. C.
DEFINITION OF CHEMICAL AND ELECTROCHEMICAL PROPERTIES OF A FUEL CELL ELECTROLYTE Interim Technical Report, 25 Mar. - 24 Dec. 1977
T. Sarada, John F. McIntyre, and R. T. Foley Feb. 1978 46 p refs
(Contract DAAK70-77-C-0080)
(AD-A050920) Avail: NTIS HC A03/MF A01 CSCL 10/2

The present research is oriented toward the task of developing an improved electrolyte for the hydrocarbon-air fuel cell. A literature study of the properties of organic acids indicated that the following types of compounds warranted further investigation: Aromatic poly carboxylic acids partially neutralized perfluoroaliphatic carboxylic acids, Mono, di and poly sulfonic acids and substituted sulfonic acids. This was followed by an experimental program wherein the vapor pressure, wetting characteristics, electrical conductivity, chemical stability, and electrochemical stability were measured. Author (GRA)

N78-22477# North Dakota Legislative Council, Bismarck.
LEGISLATIVE HANDBOOK ON ENERGY-RELATED TOPICS
1977 63 p
(Grant NSF ISP-76-10209)
(PB-276766/3; NSF/RA-770010) Avail: NTIS HC A04/MF A01 CSCL 10A

Activities are highlighted of the seven task forces created by the States of North Dakota, South Dakota, Montana, and Wyoming to study the interstate effects of the Fort Union Coal Formation which underlies parts of each of these states. Topics studied included air quality, water quality, water allocation, plant sitting, energy development, reclamation, taxation, and social and economic impact. The task forces examined methods to assist member states in problem solving as well as acquainting the members with the energy development positions and accompanying laws and regulations of their sister states. Brief summaries outlining the research performed for each task, as well as a list of the members in each group, are presented. GRA

N78-22478# City of Davis, Calif.
DAVIS ENERGY CONSERVATION REPORT, PRACTICAL USE OF THE SUN Final Report
Mar. 1977 136 p
(Grant HUD-B-75-S1-06-001)
(PB-276616/0; DAC/PL-77/101) Avail: NTIS HC A07/MF A01 CSCL 10A

A comprehensive energy conservation program for the City of Davis is described, including: Building Code, planning, solar houses, and public education. GRA

N78-22479# Mound Lab., Miamisburg, Ohio.
FEASIBILITY OF UTILIZING A FLUID ENERGY MILL IN THE GRINDING OF POTASSIUM PERCHLORATE
L. Wayne Collins 28 Sep. 1977 36 p
(Contract EY-76-C-04-0053)
(MLM-2444) Avail: NTIS HC A03/MF A01

It was found that the particle size of the material was significantly reduced by the action of the mill with no significant change in the level of contamination. The grinding parameters selected had no direct relationship with the physical properties of the final product. The action of the mill induced a significant electrostatic charge on the potassium perchlorate which affected the handling characteristics and possibly the chemical character. The feasibility but not the desirability of utilizing the fluid energy mill to grind potassium perchlorate was demonstrated. ERA

N78-22480# Purdue Univ., Lafayette, Ind.
SYSTEMS STUDIES OF COAL CONVERSION PROCESSES USING A REFERENCE SIMULATOR
G. V. Reklaitis, J. M. Woods, F. Kayihan, and M. Sood Jul. 1977 41 p refs
(Contract EX-76-C-01-2275)
(FE-2275-4) Avail: NTIS HC A03/MF A01

Preliminary user's manuals were prepared for the physical properties code package and for the process block material balancing code. The equipment calculation system was linked with the properties package and expansion of the module library was proceeding. Development work continued on the equipment costing system and the hydrotreating models. The cost data files were implemented on the computer and work was in progress on the file manipulation and costing subroutines. Literature review was complete on the hydrotreating section and semiempirical model equations have been assembled and fitted to available data. ERA

N78-22481# Argonne National Lab., Ill.
NATIONAL BATTERY TEST LABORATORY Design Report, Apr. 1976 - Apr. 1977
N. P. Yao, F. Hornstra, E. C. Berrill, C. A. Swoboda, and H. Kacinskas Jul. 1977 109 p
(Contract W-31-109-eng-38)
(ANL-OEPM-77-4) Avail: NTIS HC A06/MF A01

The design of the National Battery Test Laboratory which is being implemented to fulfill the testing requirements of anticipated ERDA battery development programs is given. The projected cell and battery test program is tabulated. The preexisting laboratory space and facilities are outlined as a prelude to describing the chosen physical configurations of the laboratory and the equipment located therein. The general features of the cell and battery cyclers are presented, and complete cycler specifications are attached as an appendix. The strategy for the computer control, data acquisition, and display system is explained. The selected computer and peripheral equipment are discussed along with the CAMAC interface system. The organization of the computer software is covered, and, finally, the arrangement of the control room is described. ERA

N78-22482# European Space Agency, Paris (France).
SOME EXPERIMENTAL RESULTS ON SELECTIVE ABSORBING SURFACES FOR LOW TEMPERATURE SOLAR COLLECTORS
Georg Paul Goerler Feb. 1978 66 p refs Transl. into ENGLISH of 'Eininge Messungen an selektiv absorbierenden Oberflaechen fuer Niedertemperatur-Solarkollektoren', DFVLR, Cologne Report DLR-FB-77-23, 27 May 1977 Original report in GERMAN previously announced as N78-14686 Original German report available from DFVLR, Cologne DM 25
(ESA-TT-432; DLR-FB-77-23) Avail: NTIS HC A04/MF A01

The efficiency of a flat plate solar collector can be greatly enhanced by the use of a selectively absorbing layer, that is, a surface with high absorptance for the solar spectrum and low emittance for thermal radiation. From various methods known from literature for realizing coatings with these properties, the process of electroplating selective black nickel coatings was chosen and studied in detail. One finding of this investigation was that the effectiveness of these layers results from optical interference. With the production of black nickel two-layer coatings on a copper substrate one obtains surfaces with an absorptance as high as 0.95 when weighted with the terrestrial solar spectrum. The simultaneous emittance is in the order of 0.05. The superiority of absorber plates with such values, in comparison with nonselective solar collectors is outlined using the results of a numerical calculation. Author (ESA)

N78-22483# Colorado Dept. of Local Affairs, Denver.
COLORADO ENERGY IMPACT ASSISTANCE PLAN
Ross M. Bolt, Lydia Watkins, and John M. Fernandez, ed. Jan. 1977 108 p
(Contract EDA-05-09-01600)
(PB-276587/3; EDA-78-016) Avail: NTIS HC A06/MF A01 CSCL 10A

A plan was developed to assist the people of Colorado in their attempts to minimize the adverse effects of energy resource development on the communities in the state. The plan provided those communities affected by energy projects with a clear, documented process for identifying their service and capital needs. Technical and financial assistance programs available to local jurisdictions are outlined, as are the varied roles of local, state and federal governments and industry to be adopted in marshalling resources to solve impact problems. GRA

N78-22484# Brookhaven National Lab., Upton, N. Y.
HEALTH AND ECONOMIC COSTS OF ALTERNATIVE ENERGY SOURCES
L. D. Hamilton and A. S. Manne (Stanford Univ.) 1977 19 p refs Presented at Intern. Conf. on Nucl. Power and its Fuel Cycles, Salzburg, Austria, 2-13 May 1977; sponsored by IAEA Sponsored by ERDA
(IAEA-CN-36/448; Conf-770505-72) Avail: NTIS HC A02/MF A01

Biomedical and environmental costs of energy production and use, including new technologies, are being considered. Beginning with a compilation of pollutants from the energy system, the various paths to man are traced and health effects evaluated. Excess mortality and morbidity in the U.S. attributable to a total fuel cycle to produce 6.6 x 10 to the 9th power kwh are being estimated. Estimates are provided of relative impacts to identifying where the important health hazards in each fuel cycle arise, thereby identifying key areas for judging the total costs of alternative energy sources, and those areas of research likely to improve the accuracy of the estimates. It was estimated that the production of electric power from all sources in the U.S. in 1975 was associated with between in U.S. ages 1 to 74. The differences in the year 2000 between health impacts of the U.S. energy system under normal growth expectations and under conditions of a nuclear moratorium were estimated. ERA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-22485*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INSTITUTIONAL ENVIRONMENTAL IMPACT STATEMENT, MICHOUD ASSEMBLY FACILITY, NEW ORLEANS, LOUISIANA Final Report
Jan. 1978 296 p refs
(NASA-TM-79437) Avail: NTIS HC A13/MF A01 CSCL 13B

A description and analysis of Michoud Assembly Facility as an operational base for both NASA and NASA-related programs and various government tenant-agencies and their contractors is given. Tenant-agencies are governmental agencies or governmental agency contractors which are not involved in a NASA program, but utilize office or manufacturing space at the Michoud Assembly Facility. The statements represent the full description of the likely environmental effects of the facility and are used in the process of making program and project decisions. Author

N78-22486*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF AIRBORNE CHLORINE AND HYDROGEN CHLORIDE GAS MEASUREMENTS FOR AUGUST 20 AND SEPTEMBER 5, 1977 VOYAGER LAUNCHES AT AIR FORCE EASTERN TEST RANGE, FLORIDA
Gerald L. Gregory, Burt R. Emerson, Jr., and Charles H. Hudgins Jan. 1978 40 p refs
(NASA-TM-78673) Avail: NTIS HC A03/MF A01 CSCL 13B

Airborne chlorine and hydrogen chloride measurements were made in the tropospheric ground cloud following the Voyager launches of August 20 and September 5, 1977. The maximum observed hydrogen chloride concentration for both launches was about 25 to 30 parts per million (ppm) occurring typically 2 to 6 minutes after launch. By completion of the sampling mission (1-1/2 hours for August, 4-1/2 hours for September), the maximum in-cloud concentration decayed to about 1 to 2 ppm. Maximum observed chlorine concentrations were about 40 to 55 parts per billion (ppb) about 2 to 8 minutes after launch; by about 15 minutes after launch, chlorine concentrations were less than 10 ppb (detection limit). In-cloud chlorine concentrations were well below 1 percent of hydrogen chloride concentrations. The appendix of the report discusses the chlorine instrument and the laboratory evaluation of the detector. Author

N78-22487# Federal Energy Administration, Washington, D. C.
STRATEGIC PETROLEUM RESERVE. TEXOMA GROUP SALT DOMES. DRAFT ENVIRONMENTAL IMPACT STATEMENT. VOLUME 1: WEST HACKBERRY EXPANSION, BLACK BAYOU, VINTON, BIG HILL
Sep. 1977 387 p refs
(FEA/S-77/323-Vol-1; DES-77-8-Vol-1) Avail: NTIS HC A17/MF A01

A site specific Environmental Impact Statement (EIS) is presented for four proposed candidate sites from the Texoma group of salt domes located in the Gulf Coast region of southwestern Louisiana and southeastern Texas. The primary site for Strategic Petroleum Reserve (SPR) development in this group is an expansion of the West Hackberry Early Storage Reserve (ESR) facility located in Cameron, Parish, Louisiana. The three other candidates are new sites. They are the Black Bayou salt dome located in Cameron Parish, Louisiana, the Vinton salt dome in Calcasieu Parish, Louisiana, and the Big Hill salt dome in Jefferson County, Texas. One or a combination of these three sites may be developed as an alternative to the expansion of the West Hackberry ESR facility. This site specific EIS analyzes the environmental impacts caused by site preparation and operation at each of the four locations. Author

N78-22488# Federal Energy Administration, Washington, D. C.
STRATEGIC PETROLEUM RESERVE. TEXOMA GROUP SALT DOMES. DRAFT ENVIRONMENTAL IMPACT STATEMENT. VOLUME 2, APPENDICES A AND B: WEST HACKBERRY EXPANSION, BLACK BAYOU, VINTON, BIG HILL
Sep. 1977 440 p refs
(FEA/S-77/323-Vol-2; DES-77-8-Vol-2) Avail: NTIS HC A19/MF A01

A description is given of the regional environment of the proposed salt dome site, West Hackberry, and the environment of the three alternate sites - Black Bayou, Vinton, and Big Hill. Regional geology, water environment, climatology, air quality, ecosystems, natural and scenic resources, archaeological and historical resources, and socioeconomic characteristics are discussed. The environmental setting of the sites, the crude oil distribution systems, brine disposal systems, and the displacement/leaching water systems are also discussed. The oil storage facilities are presently in the preliminary design stage. Engineering feasibility analyses were prepared as the basis for evaluation of the socioeconomic and environmental impaces of the project. Author

N78-22489# Federal Energy Administration, Washington, D. C.
STRATEGIC PETROLEUM RESERVE. TEXOMA GROUP SALT DOMES. DRAFT ENVIRONMENTAL IMPACT STATEMENT. VOLUME 3, APPENDIX C: WEST HACKBERRY EXPANSION, BLACK BAYOU, VINTON, BIG HILL
Sep. 1977 424 p refs
(FEA/S-77/323-Vol-3; DES-77-8-Vol-3) Avail: NTIS HC A18/MF A01

A detailed evaluation of the environmental impacts which would be associated with the construction and operation of the four candidate SPR salt dome sites is given. A discussion of impacts associated with alternative facility components is provided. Author

N78-22490# Federal Energy Administration, Washington, D. C.
STRATEGIC PETROLEUM RESERVE. TEXOMA GROUP SALT DOMES. DRAFT ENVIRONMENTAL IMPACT STATEMENT. VOLUME 4, APPENDICES D-S: WEST HACKBERRY EXPANSION, BLACK BAYOU, VINTON, BIG HILL
Sep. 1977 657 p refs
(FEA/S-77/323-Vol-4; DES-77-8) Avail: NTIS HC A99/MF A01

Precipitation data are given for the areas of Texas and Louisiana in which primary and secondary sites would be located. The possibilities of oil spills occuring and their ecological consequences are discussed. Additional data are given on possible effects of brine spills, tanker collisions, hydrocarbon emissions and other environmental hazards associated with the project. P.R.A.

N78-22491*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
LASER DOPPLER VELOCIMETER AERIAL SPRAY MEASUREMENTS

Andrew D. Zalay, William R. Eberle, Robert E. Howle, and Kenneth R. Shrider Apr. 1978 223 p refs
(Contract NAS6-2825)
(NASA-CR-141433) Avail: NTIS HC A10/MF A09 CSCL 13B

An experimental research program for measuring the location, spatial extent, and relative concentration of airborne spray clouds generated by agricultural aircraft is described. The measurements were conducted with a ground-based laser Doppler velocimeter. The remote sensing instrumentation, experimental tests, and the results of the flight tests are discussed. The cross section of the aerial spray cloud and the observed location, extent, and relative concentration of the airborne particulates are presented It is feasible to use a mobile laser Doppler velocimeter to track and monitor the transport and dispersion of aerial spray generated by an agricultural aircraft. Author

N78-22492# School of Aerospace Medicine, Brooks AFB, Tex.
ANALYSIS OF TRACE VOLATILES BY GAS CHROMATOGRAPHY/MASS SPECTROMETER DATA SYSTEM Interim Report, Jan. 1976 - Oct. 1977
Charles L. Martin, William W. Lackey, James P. Conkle, and Richard L. Miller Dec. 1977 19 p refs
(AD-A050912; SAM-TR-77-28) Avail: NTIS HC A02/MF A01 CSCL 13/2

Methods and procedures are described for the analysis of trapped volatile samples by gas chromatography-mass spectrometry. The Tenax-GC sorbent tube sampler (stainless steel) and the desorption heater block described were developed in this laboratory to satisfy a USAF need for a field sampling method to complement the SAM cryogenic trapping system. The treatment of both sorbent-trapped and cryogenically-trapped samples is discussed showing that analysis and data reduction for sorbent tube samples are considerably less than that required for cryogenic samples. While the sorbent tube sampling method has advantages of lower cost, ease of portability, simplicity, and reduced analysis time, the cryogenic sampling system is the preferred method for trapping light hydrocarbons of less than five carbon atoms. Author (GRA)

N78-22493# Research Triangle Inst., Research Triangle Park, N. C.
MULTIMEDIA ENVIRONMENTAL GOALS FOR ENVIRONMENTAL ASSESSMENT, VOLUME 1 Final Task Report, Mar. - Oct. 1977
J. G. Cleland Nov. 1977 353 p refs
(Contract EPA-68-02-2612)
(PB-276919/8; EPA-600/7-77-136a-Vol-1) Avail: NTIS HC A16/MF A01 CSCL 13B

In the context of deriving multimedia environmental goals (MEG's), this report: (1) offers perspective on the broad range of contaminants whose control is vital to both industry and the public; (2) further develops and defines indicators designating contaminants which must be given priority consideration for immediate control and for subsequent research; and (3) brings existing and emerging data together for use in environmental assessment. Some basic methodologies were explored which provide the present MEG's, and which also suggest directions for defined methodologies. Author

N78-22494# Research Triangle Inst., Research Triangle Park, N. C.
MULTIMEDIA ENVIRONMENTAL GOALS FOR ENVIRONMENTAL ASSESSMENT. VOLUME 2: MEG CHARTS AND BACKGROUND INFORMATION Final Task Report, Mar. - Oct. 1977
J. G. Cleland and G. L. Kingsbury Nov. 1977 454 p refs
(Contract EPA-68-02-2612)
(PB-276920/6; EPA-600/7-77-136b-Vol-2) Avail: NTIS HC A20/MF A01 CSCL 13B
For abstract, see N78-22493.

N78-22495# Southern Research Inst., Birmingham, Ala.
PARTICULATE CONTROL HIGHLIGHTS: RESEARCH ON ELECTROSTATIC PRECIPITATOR TECHNOLOGY Final Report, Nov. 1976 - Nov. 1977
S. Oglesby, Jr. and G. Nichols Dec. 1977 23 p refs
(Contract EPA-68-02-2114)
(PB-276643/4; SORI-EAS-77-677; EPA-600/8-77-020a) Avail: NTIS HC A02/MF A01 CSCL 13B

Highlights are given of a major EPA research program on electrostatic precipitator (ESP) technology, directed toward improving the performance of ESPs in controlling industrial particulate emissions, notably fly ash from coal combustion in electric power plants. Relationships between electrical effects, such as reverse corona, caused by high resistivity of the deposited fly ash, were investigated. The influence of fly ash particle size and chemical composition on the resistivity and dielectric strength of the deposited fly ash was also studied. Relationships were between fly ash resistivity and chemical composition, especially its alkali metal content, for ESP operating temperatures below about 250C. Based on these relationships, a mechanism for ionic surface conduction was that complements the ionic mechanism in bulk conduction in fly ash particles at higher operating temperatures. The efficacy of conditioning fly ash by adding SO3 to flue gas (to lower fly ash resistivity) was established in trials at electric power plants. GRA

N78-22496# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
MODELING THE DISPERSION OF ATMOSPHERIC POLLUTION USING CUBIC SPLINES AND CHAPEAU FUNCTIONS
D. W. Pepper and C. D. Kern 1977 45 p refs Presented at Intern. Symp. on Computer Methods for Partial Differential Equations, Bethlehem, Pa., 22 Jun. 1977 Submitted for publication
(Contract EY-76-C-09-0001)
(DP-MS-76-83; Conf-770619-5) Avail: NTIS HC A03/MF A01

A quasi-Lagrangian cubic-spline method and a chapeau-function method are investigated and numerical results compared in advecting a passive scalar. Both methods are simple to use, computationally fast, and give reasonably accurate results. Little numerical dissipation is manifested by either scheme. In simple advection tests with equal mesh spacing, chapeau functions are more accurate than the quasi-Lagrangian cubic-spline method for maintaining peak concentration values. In tests with unequal mesh spacing, cubic-spline methods have lower reflectivity (noise) than chapeau functions and maintain slightly more accurate concentration distributions. Both cubic splines and chapeau functions are used to solve the dispersion of gaseous emissions in three dimensions over the Savannah River Plant(SRP). Real-time winds are obtained from measured data and interpolated to nodal points. Vertical diffusion is calculated from similarity theory and an O'Brien cubic profile. Results obtained from chapeau functions are compared to measured data after the 1974 accidental tritium release from SRP. ERA

N78-22497# Cottrell Environmental Systems, Inc., Bound Brook, N. J.
DEVELOPMENT OF A HIGH-TEMPERATURE/HIGH-PRESSURE ELECTROSTATIC PRECIPITATOR Final Report, Aug. 1975 - Aug. 1977
J. R. Bush, R. L. Feldman, and M. Robinson Nov. 1977 85 p refs
(Contract EPA-68-02-2104)
(PB-276626/9; EPA-600/7-77-132) Avail: NTIS HC A05/MF A01 CSCL 13B

Results are given of a laboratory test demonstrating the feasibility of electrostatic precipitation at high temperatures and pressures. Corona currents were stable at all temperatures. Detailed current/voltage characteristics under negative and positive polarity were obtained in dry air, in a simulated combustion gas, and in a substitute fuel gas for each temperature and pressure level. Major effects of temperature, pressure, and electrode geometry on precipitator design characteristics (sparking voltages, corona starting voltages, and current levels) were evaluated. It is established that no practical temperature or pressure limitation exists to the levels tested. A preliminary cost estimate is presented for a commercial-size precipitator design applied to a commercial fluidized-bed combustor and turbine system. GRA

N78-22498# Pikes Peak Area Council of Governments, Colorado Springs, Colo.
COMPREHENSIVE PLANNING FOR AIR QUALITY CONTROL Final Report
Julian Beaver Jan. 1978 149 p
(Contract EPA-68-01-4178)
(PB-276717/6; EPA-400/9-78-002) Avail: NTIS HC A07/MF A01 CSCL 13B

The relationship of air pollution to the performance of city systems is reported. A methodology is outlined for evaluating the air pollution impacts of growth and development, and a framework is provided for incorporating air quality as a criterion in the comprehensive planning process. GRA

N78-22499# Environmental Monitoring and Support Lab., Las Vegas, Nev. Monitoring Systems Research and Development Div.
THE STATUS AND QUALITY OF RADIATION MEASUREMENTS FOR AIR
D. G. Easterly, R. R. Kinnison, A. N. Jarvis, and R. F. Smiecinski Oct. 1977 44 p refs Sponsored by EPA
(PB-276813/3; EPA-600/4-77-043) Avail: NTIS HC A03/MF A01 CSCL 18I

As part of the radiation quality assurance program conducted by the U. S. Environmental Protection Agency, calibrated radionuclide solutions are distributed to participating laboratories for instrument calibration and yield determinations. Laboratory performance studies involving the analysis of radionuclides in environmental media are also conducted. A summary is given of the results of the air filter cross-check program for 1973-1975. Examination of these results indicate that gross alpha is the least difficult (86 percent within the control limits for accuracy) and gross beta is the most difficult (39 percent within the control limits for accuracy) for the laboratories to analyze. GRA

N78-22500# Environmental Protection Agency, Research Triangle Park, N.C. Emissions Standards and Engineering Div.
CONTROL OF VOLATILE ORGANIC EMISSIONS FROM STORAGE OF PETROLEUM LIQUIDS IN FIXED ROOF TANKS
Richard K. Burr, Kerri C. Brothers, and Robert Quaney Dec. 1977 44 p refs
(PB-276749/9; EPA-450/2-77-036; OAQPS-1.2-089) Avail: NTIS HC A03/MF A01 CSCL 13B

This report provides the necessary guidance for development of regulations limiting emissions of volatile organic compounds (VOC) from the storage of petroleum liquids in fixed roof tanks. Reasonably available control technology (RACT) is defined in this document; cost analysis for RACT is included for evaluating the cost effectiveness of controlling fixed roof storage tank resources. GRA

N78-22501# Research Corp. of New England, Wethersfield, Conn.
SYMPOSIUM ON FUGITIVE EMISSIONS: MEASUREMENT AND CONTROL
J. King, comp. Dec. 1977 544 p Conf. held at Houston, Tex., 23-25 May 1977
(Contract EPA-68-02-2133)
(PB-276973/5; EPA-600/7-77-148) Avail: NTIS HC A23/MF A01 CSCL 13B

The proceedings are a compilation of technical papers prepared for presentation at the Second Symposium on Fugitive Emissions, May 23-25, 1977, Houston, Texas. The papers discuss the scope and impact of fugitive emissions (non-point sources) and present techniques which have been used to measure these emissions. Fugitive emissions control technologies are also discussed. GRA

N78-22502# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Medical and Biological Effects of Environmental Pollutants.
PLATINUM-GROUP METALS
Sep. 1977 352 p refs
(Contract EPA-68-02-1226)
(PB-276828/1; EPA-600/1-77-040) Avail: NTIS HC A16/MF A01 CSCL 06T

Information (up to April 1976) about the effects on man and his environment that result either directly or indirectly from pollution by platinum group metals is given: iridium (Ir), osmium (Os), palladium (Pd), platinum (Pt), rhodium (Rh) and ruthenium (Ru). The document describes physical and chemical properties, sources, measurement, and effects on plants, animals, and humans. The information presented is supported by references to the scientific literature. GRA

N78-22413# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE GEOCHEMISTRY OF AERIAL MIGRANTS, PART 2
In its Geochem. of Elem. in the Supergene Zone 1977 p 40-96 refs (For availability see N78-22411 13-42)
Copyright. Avail: NTIS HC A12/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-22503 Saint Louis Univ., Mo.
A NUMERICAL INVESTIGATION OF THE METEOROLOGICAL AND PHOTOCHEMICAL PROCESSES WHICH INFLUENCE TROPOSPHERIC OZONE AND OTHER TRACE CONSTITUENTS Ph.D. Thesis
Jack Fishman 1977 122 p
Avail: Univ. Microfilms Order No. 78-00484

It is shown that if ozone was treated as an inert species in the troposphere, larger vertical eddy diffusion coefficients and an ozone flux from the stratosphere must be used to reproduce the observed tropospheric ozone profiles in the northern hemisphere mid latitudes during the summer. The possibility that methane oxidation reactions were responsible for the production of ozone in the troposphere was examined. The results of the two dimensional model indicated that ozone can be produced in the troposphere downwind from an area of anthropogenic emissions of carbon monoxide and nitrogen oxides. Dissert. Abstr.

N78-22504 California Univ., San Diego.
GEOMAGNETIC FIELD-ALIGNED IRREGULARITIES OF PLASMA DENSITY IN ARTIFICIAL HEATING PROCESS AND IN EQUATORIAL SPREAD F Ph.D. Thesis
Min-Chang Lee 1977 179 p
Avail: Univ. Microfilms Order No. 77-32815

Two phenomena observed in ionospheric modification experiments and one naturally occurring phenomenon were investigated. They are the generation of intense small-scale field aligned density irregularities, ion line enhancement, and equatorial spread F. The saturation spectrum of plasma waves generated by an O-mode heater wave via parametric instabilities is believed to be responsible for the occurrence of the first two phenomena after the ionospheric heating. The thermal coupling of plasma waves via Joule heating produce the small scale field aligned density irregularities, while the coupling of plasma waves via ponderomotive force results in the ion line enhancement. Equatorial spread F is interpreted as the generation of field aligned density irregularities by instabilities. Dissert. Abstr.

N78-22505 Washington Univ., St. Louis, Mo.
AN INVESTIGATION OF THE SOUTHERN POLAR IONOSPHERIC D-REGION USING A VERY LOW FREQUENCY PULSE IONOSOUND Ph.D. Thesis
Alan Scott Chandler 1977 96 p
Avail: Univ. Microfilms Order No. 7800911

The ionosound data consist of synoptic, digitally recorded ionospheric reflection coefficient phase and, sporadic amplitude measurements recorded photographically. The phase measurements used the transmitting antenna current as the phase reference and the phase path was from the antenna to the ionospheric D region, to a ground based VLF receiver situated 20 km from the transmitter site and finally, back to the transmitter site via an UHF telemetry link. The D region ionosound relative reflection coefficient amplitude data was used to estimate the

electron density profiles during a solar proton event. The ion electron pair production rates determined for this event were used with the electron density profiles to find the effective recombination coefficient profile. Dissert. Abstr.

N78-22506 Pennsylvania State Univ., University Park.
THE PALEOMAGNETISM OF MESOZOIC DIABASE AND THE DEFORMATIONAL HISTORY OF SOUTHEASTERN PENNSYLVANIA Ph.D. Thesis
Karen Wagner Volk 1977 164 p
Avail: Univ. Microfilms Order No. 7803376

The paleomagnetic data of the Rossville-type diabase sheets and dikes provided excellent resolution of the postintrusive deformational events in southeastern Pennsylvania. A series of events describing the tectonic history of southeastern Pennsylvania were constructed as follows: (1) Deposition of sediments probably occurred in a crustal downwarp with the axis of maximum sedimentation moving northwestward with time. (2) Dikes and sheets of York Haven-type diabase intruded while the sediments were essentially undeformed. (3) Approximately 10 deg NW tilting of the basin and possibly some surrounding areas was caused by rotation on small fault blocks; possibly some folds developed at this time. (4) The Rossville type diabase intruded, in part as sheets subparallel to the bedding, and in part as dikes both inside and outside the basin. (5) Continued northwest tilting of fault blocks was coupled with folding along a northwest trending axis. Dissert. Abstr.

N78-22507 Wisconsin Univ., Madison.
MAGNETOTELLURIC MEASUREMENTS OF CONDUCTIVITY ANOMALIES IN NORTHERN WISCONSIN Ph.D. Thesis
Charles Thomas Young 1977 165 p
Avail: Univ. Microfilms Order No. 7727775

Four channel magnetotelluric measurements in the frequency range 1 to 50 Hz were made, in an array of stations spaced 10 to 1000 meters apart, over linear conductors of copper sulfide and graphitic schist. The R-max and R-min data over the conductive schist were modelled by a long narrow conductor or 0.3 ohm meter resistivity having a width of 120 meters, and a depth of 80 meters, buried 40 meters beneath the surface. The minesite model was developed from drill hole data, a resistivity log and nearby DC resistivity measurements. Dissert. Abstr.

N78-22508 Pennsylvania State Univ., University Park.
THE OCCURRENCE AND CRYSTAL CHEMISTRY OF NICKEL IN SILICATE AND HYDROXIDE MINERALS Ph.D. Thesis
David L. Bish 1977 161 p
Avail: Univ. Microfilms Order No. 7803309

A study was made of the structures and chemistry of several common nickel silicate and hydroxide minerals by utilizing X-ray powder and single crystal diffractometry, infrared and optical absorption spectroscopy, transmission electron microscopy, and chemical analysis. Results of the investigation were used in understanding the minerals' modes of formation and in clarifying the crystal chemistry of nickel in all silicate and hydroxide minerals. Dissert. Abstr.

N78-22509 Colorado School of Mines, Golden.
IN SITU STRESS MEASURED AT RAINIER MESA, NEVADA, AND A FEW GEOLOGIC IMPLICATIONS Ph.D. Thesis
John Rodda Ege 1977 226 p
Avail: Univ. Microfilms Order No. 78-02780

Measurements of the three dimensional stress field were obtained in tunnels driven in Tertiary ash fall tuff under Rainier Mesa at the Nevada Test Site. The sites are distributed under an area of 17 sq km and are at an average depth of 389 m. Whereas maximum compression during late Precambrian to Tertiary time remained essentially east-west, a complete reversal then occurred, with formation of normal faults, dipslip, strike-slip, and oblique fault movement and regional northwesterly extension. The measured stress field is consistent with these failure mechanisms. Dissert. Abstr.

N78-22510 Colorado School of Mines, Golden.
REMOTE SENSING APPLIED TO EXPLORATION FOR VEIN-TYPE URANIUM DEPOSITS, FRONT RANGE, COLORADO Ph.D. Thesis
James Carryl Fisher 1976 170 p
Avail: Univ. Microfilms Order No. 78-02796

A remote sensing program consisting of two main sensors, medium altitude black and white photography and low altitude color photography, adequately mapped most of the important geologic features and ore controls. Medium altitude black and white photography was useful to map major throughgoing fracture trends, major metamorphic foliation trends major rock types, and areas of intense fault branching. Low altitude color photography was useful to map and differentiate limonitic and hematitic color anomalies, details of fault and foliation intersections, lithologies, and breccia-zone indications. Together, these two sensors could be used effectively to outline target areas which would lead to a more successful ground based uranium exploration program. Dissert. Abstr.

N78-22511 Columbia Univ., New York.
UPPER PLEISTOCENE CLIMATIC VARIATIONS IN THE SOUTH ATLANTIC DERIVED FROM A QUANTITATIVE RADIOLARIAN ANALYSIS: ACCENT ON THE LAST 18,000 YEARS Ph.D. Thesis
Joseph James Morley 1977 359 p
Avail: Univ. Microfilms Order No. 78-04379

Comparison of the subtropical temperature curve with a subantarctic temperature curve disclosed several times during the last 400,000 years when the records showed significantly different sea surface temperature estimates. This indicated that changing climatic conditions in subtropical and equatorial regions were not always directly linked to variations in climate in polar regions. During the last 700,000 years, large amplitude changes seen in the oxygen isotope curve did not necessarily coincide with major changes in sea surface temperature estimates in the southeastern portion of the South Atlantic suggesting that major climatic episodes in the northern hemisphere were not consistently matched by climatic events of similar intensity in the southern hemisphere. Dissert. Abstr.

N78-22512 Illinois Univ., Urbana-Champaign.
ENERGETIC PARTICLES AND IONIZATION IN THE MIDDLE AND LOW LATITUDE IONOSPHERE Ph.D. Thesis
Henry David Voss 1977 324 p
Avail: Univ. Microfilms Order No. 7804187

Nike Apache rockets, each equipped with an energetic particle spectrometer and electron density experiments, launched from Virginia and Peru, under varying geomagnetic particle flux were found to be strongly dependent on Kp. The height averaged ionization rates derived from the electron density profiles were consistent with the rates calculated from the observed total particle flux. Two precipitation zones were identified at midlatitudes. It was calculated that particles were the dominant source of nighttime ionization in the above precipitation zones. Dissert. Abstr.

N78-22513 Direction de la Meteorologie Nationale, Paris (France). Section de Meteorologie Maritime.
THE ICEBERGS OF THE NORTH ATLANTIC OCEAN [LES ICEBERGS DE L'ATLANTIQUE NORD]
J. Darchen Oct. 1977 36 p refs In FRENCH
(MN-Mono-104) Avail: Issuing Activity

The occurrence of icebergs in the North Atlantic Ocean is discussed. Topics include formation of icebergs on the coast of Greenland, the life of an iceberg, icebergs in navigation zones, study and surveillance of icebergs, and detection of icebergs onboard ship. ESA

N78-22514# Finnish Meteorological Inst., Helsinki.
METEOROLOGICAL YEARBOOK OF FINLAND. VOLUME 76, PART 1A: CLIMATOLOGICAL DATA
1978 118 p In ENGLISH and FINNISH
(ISBN-951-697-096-6; ISSN-0076-6747) Avail: NTIS HC A06/MF A01

Meteorological tables were drawn up according to the principles laid down by the International Meteorological Organization. They contain daily observations from 12 stations and monthly and annual summaries from 161 stations. The processing of climatic data was done on a Datasaab D 22. Information required for calculating the summaries for synoptic stations was extracted directly from the teleprinter messages received on paper tape. Author

N78-22515# Finnish Meteorological Inst., Helsinki.
OBSERVATIONS OF RADIOACTIVITY, NO. 16, 1976
1977 67 p
Avail: NTIS HC A04/MF A01

Measurements of radionuclides in air and rainwater are presented. Hourly values for 1976 of short lived beta activity, decayed within 4 hours, and long lived beta activity, remaining 5 days after the sampling period, are given. Beta activity measurements in precipatation and settled dust collected in Helsinki and Ivalo are included. Author

N78-22516# Finnish Meteorological Inst., Helsinki.
MAGNETIC RESULTS FROM NURMIJARVI GEOPHYSICAL OBSERVATORY, NO 18, 1976
1977 31 p
(ISBN-951-697-100-8; ISSN-0071-5212) Avail: NTIS HC A03/MF A01

Absolute measurements of H and Z were made with a vector proton magnetometer. Serson's method was used: an artificial field A of roughly 2H in the magnetic N-S direction was produced by a horizontal Helmholz coil 82 cm in diameter. Keeping A constant, the coil was turned 180 degrees around an exactly vertical axis for another reading. The QHMs and the proton magnetometer were compared with the Rude Skov standards at the Rude Skov Observatory. The Rude Skov standard for H was found to be the same as the Nurmijarvi standard within the accuracy of the measurements. Author

N78-22517*# Radio Sciences Co., Melbourne, Fla.
EVALUATION OF ENERGETIC PARTICLE EFFECTS ON BUV DATA AND ATMOSPHERIC OZONE Final Report, Jan. - Sep. 1977
John R. Herman 7 Oct. 1977 43 p refs
(Contract NAS5-23873)
(NASA-CR-156744; RSCR-77-5) Avail: NTIS HC A03/MF A01 CSCL 04A

To aid investigations of energetic particle effects on the backscattered ultraviolet (BUV) instrumentation aboard Nimbus 4, solar proton events characterized as polar cap absorption events occurring in the period April 1970 to April 1976 were summarized. Energetic particle effects on total ozone above the 4 mb pressure level measured by Nimbus 4 were analyzed. Proceedings of a workshop meeting of operation aurorozone are included as background material for possible effects of bremsstrahlung on atmospheric ozone. Author

N78-22518# Geophysical Observatory, Sodankyla (Finland).
PROPERTIES OF THE SPORADIC E LAYER AT SODANKYLA
Tauno Turunen 1977 101 p refs Presented at Oulu Univ., Finland, 20 May 1977
(Rept-21; ISBN-951-42-0440-9) Avail: NTIS HC A06/MF A01

Properties of the Sporadic E (Es) layer were investigated by using ionospheric data. In some cases special experiments were arranged to get information not obtainable from the standard data. Midlatitude types of Es are seen mostly in summer time and appear in two waves the first commencing in the morning and the second in the evening. Waves especially appear in the height of Es layers. Events related to the evening wave are usually stronger than events related to the morning wave. The driving force is the semidiurnal component of the atmospheric tidal wave. Auroral zone types of Es layers occur throughout the year in the evening and night time. Weak diffuse echoes from the lower boundary of E layer can be seen in ionograms under low noise conditions practically always when measuring at very high gain level. Author

N78-22519# Geophysical Observatory, Sodankyla (Finland).
OBSERVATION OF GRAVITY WAVES IN THE HIGH-LATITUDE F-LAYER BY USING FIXED FREQUENCY SOUNDING
T. Turunen and T. Nygren Jan. 1978 15 p refs
(Rept-22) Avail: NTIS HC A02/MF A01

Fixed frequency soundings at 4.2 MHz frequency were carried out using aerials with a northward tilted antenna pattern. The second order echo in virtual height versus time recording occasionally shows a peculiar sawtooth behaviour. Model calculations indicate that the phenomenon can be explained by medium scale gravity waves in the F layer. The period of the gravity wave can be reduced most accurately from the second order trace, and it is possible to make a distinction between the poleward and the equatorward propagation of the disturbance. The measured periods vary from 15 to 65 minutes. In the daytime, when the measurement is possible, the propagation is invariably equatorwards. The phenomenon is only observable during the winter months. It does not seem to have any correlation with magnetic activity. Author

N78-22520# Direction de la Meteorologie Nationale, Paris (France).
MEASUREMENT OF THE ATMOSPHERIC RADIATION BUDGET BASED ON RADIATION PRESSURE [ETUDE DE LA MESURE DU BILAN RADIATIF ATMOSPHERIQUE PAR L'INTERMEDIAIRE DE LA PRESSION DE RADIATION]
ESA Jul. 1977 82 p refs In FRENCH; ENGLISH summaries Prepared jointly with ONERA, ONERA/DERTS, and Centre d'Etudes et de Rech. Geodyn. et Astron.
(Contract ESA-2902/76-F-WMT(SC))
(ESA-CR(P)-1003) Avail: NTIS HC A05/MF A01

The feasibility of using a miniaccelerometer as a radiation pressure sensor onboard a satellite, in order to determine the atmospheric radiation budget, is discussed. The potential interest of such measurements to climatology is outlined. The French CACTUS experiment for radiation pressure measurement is described, as well as the data reduction techniques required to distinguish solar, infrared, and earth-reflected radiation pressure components. The influence of the satellite's attitude and of electrostatic and gravitational effects on the accuracy of the measurements is discussed, and improvements proposed. The determination of radiant flux from radiation pressure is considered, taking into account surface properties of the satellite. A proposal is made for an atmospheric radiation budget mission, based on an improved CACTUS experiment. For individual titles, see N78-22521 through N78-22527.

N78-22521# Direction de la Meteorologie Nationale, Paris (France).
FIELD OF INTEREST FOR A WIDE FIELD SENSOR
Claude Pastre *In its* Meas. of the Atmospheric Radiation Budget Based on Radiation Pressure Jul. 1977 42 p refs In FRENCH; ENGLISH summary (For availability see N78-22520 13-46)
Avail: NTIS HC A05/MF A01

A miniaccelerometer may be considered as a wide field sensor. It allows the measurement of the radiation flux reaching the surface of the satellite integrated in wave-lengths. Such measurements can be very useful in estimating the radiative balance of the earth. But this interest seems to be rather in the estimation of the budget on a global scale, than on a smaller synoptic scale. Time and space scales are specified. The desirable or useful accuracy for meteorology is given (GARP report). Certain features of the terrestrial surface are described from the point of view of absorption, diffusion, reflection of the solar light as well as from the point of view of emission. Consequences are discussed upon the reduction of accelerometer measurements.
Author (ESA)

N78-22522# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COMPARISON OF SCIENTIFIC RESULTS OBTAINED BY CACTUS AND OTHER ACCELEROMETERS [COMPARAISON DES RESULTATS SCIENTIFIQUES OBTENUS PAR CACTUS ET LES AUTRES ECCELEROMETRES]
Anne-Marie Mainguy *In its* Meas. of the Atmospheric Radiation Budget Based on Radiation Pressure Jul. 1977 22 p refs In FRENCH; ENGLISH summary (For availability see N78-22520 13-46)
Avail: NTIS HC A05/MF A01

A short description of several low-g accelerometers built in France, Italy, and the USA is given. Results obtained are indicated with particular scope of each experiment. At present CACTUS seems the most appropriate to measure the radiation pressure effect. Author (ESA)

N78-22523# Centre d'Etudes et de Recherches Geodynamiques et Astronomiques, Grasse (France).

REDUCTION IN MEASUREMENTS IN ORDER TO DETERMINE THE RADIATION PRESSURE USING A CACTUS TYPE MINIACCELEROMETER [REDUCTION DES MESURES EN VUE DE DETERMINER LA PRESSION DE RADIATION A PARTIR D'UN MICROACCELEROMETRE TYPE CACTUS]
Jean-Jacques Walch and Yves Boudon *In its* Meas. of the Atmospheric Radiation Budget Based on Radiation Pressure Jul. 1977 14 p ref In FRENCH; ENGLISH summary (For availability see N78-22520 13-46)
Avail: NTIS HC A05/MF A01

The knowledge of internal parameters is necessery to determine the radiation pressure from CACTUS measurements. If some parameters can be determined on the ground, other parameters must be determined during the orbital flight such as the electric charge of the proof-mass. The perturbing internal accelerations can be subtracted from the total accelerations in order to determine the external accelerations, as the solar radiation pressure effect. The accuracy of results is a function of the level of the perturbing forces and of the precision with which these forces are determined. Different problems are reviewed and improvement possibilities are deduced as the order of magnitude of perturbing forces. A method is suggested to determine separately the direct solar pressure, the terrestrial infrared radiation pressure, the rediffused solar radiation pressure. The accuracy of these estimations is given. Author (ESA)

N78-22524# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PRINCIPLE OF MEASUREMENT [PRINCIPE DE LA MESURE]
Anne-Marie Mainguy *In its* Meas. of the Atmospheric Radiation Budget Based on Radiation Pressure Jul. 1977 6 p In FRENCH (For availability see N78-22520 13-46)
Avail: NTIS HC A05/MF A01

The principle of radiation pressure measurement with a satellite-borne accelerometer is explained using simplified hypotheses. It is shown that by using this measurement and the satellite trajectory, it is possible to provide an evaluation of the global flux in order to examine the radiative balance of the earth. ESA

N78-22525# Departement d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).
OPTICAL PROPERTIES OF SATELLITE COATINGS [PROPRIETES OPTIQUES DES REVETEMENTS DE SATELLITE]
A. Paillous and M. Romero *In its* Meas. of the Atmospheric Radiation Budget Based on Radiation Pressure Jul. 1977 41 p refs In FRENCH; ENGLISH summary (For availability see N78-22520 13-46)
Avail: NTIS HC A05/MF A01

The value of the radiative flux integrated over the different wavelengths can be deduced from the radiation pressure exerted by this flux. To enable this, the optical properties of the surface (reflectance, absorption, diffusion) must be known as function of various parameters. These features are reviewed and compositions of surface coatings are analyzed as to their properties in the estimation of flux. Author (ESA)

N78-22526# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PRELIMINARY DESIGN OF A SUPER CACTUS [AVANT-PROJECT D'UN SUPER CACTUS]
R. Juillerat *In its* Meas. of the Atmospheric Radiation Budget Based on Radiation Pressure Jul. 1977 28 p refs In FRENCH; ENGLISH summary (For availability see N78-22520 13-46)
Avail: NTIS HC A05/MF A01

The sensitivity of CACTUS is found to be higher than predicted before the launching. Characteristics of CACTUS were studied during its orbital flight and significant improvements can be suggested without developing new technological concepts of CACTUS. Author (ESA)

N78-22527# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
FIRST ELEMENTS OF A PROPOSAL FOR A SATELLITE SYSTEM [PREMIERS ELEMENTS D'UNE PROPOSITION D'UN SYSTEME SATELLITE]
Anne-Marie Mainguy *In its* Meas. of the Atmospheric Radiation Budget Based on Radiation Pressure Jul. 1977 22 p refs In FRENCH; ENGLISH summary (For availability see N78-22520 13-46)
Avail: NTIS HC A05/MF A01

A proposal is made for a spherical, rather light satellite (diameter 1.60 m - mass 106 kg) having on board a super-CACTUS. The orbit of this satellite would be circular, with an altitude of the order of 1000-1200 km. One could foresee two missions: an equatorial one and a polar one. Results of previous studies on attitude restitution and thermal budget were used in this proposal. Author (ESA)

N78-22528# Ghana Univ., Legon. Dept. of Physics.
STUDY OF THE EQUATORIAL IONOSPHERE: THE EQUATORIAL EVENING MINIMUM IN THE TOTAL ELECTRON CONTENT OF THE IONOSPHERE AND ITS ROLE IN EQUATORIAL SCINTILLATION Final Report, 1 Jan. 1974 - 30 Sep. 1977
John R. Koster 30 Nov. 1977 39 p
(Grant AF-AFOSR-2628-74)
(AD-A050647; AFGL-TR-78-0042) Avail: NTIS HC A03/MF A01 CSCL 04/1

A minimum in the total electron content of the equatorial ionosphere frequently appears shortly after sunset in measurements of Faraday rotation made at Legon, Ghana (latitude 5.63 deg N, longitude -0.19 deg E, magnetic dip 8 deg S). This paper describes the phenomenon and investigates its occurrence characteristics over a period of six years. It concludes that the effect is due to a transport phenomenon described as a 'circulation cell' which follows the sunset line. This circulation is not considered to be the primary cause of the production of irregularities in the night time F region, but the mechanism is thought to contribute both to the intensity and the duration of the resulting scintillation. Author (GRA)

N78-22529# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEISMIC DISCRIMINATION Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1977
Michael A. Chinnery 30 Sep. 1977 87 p refs
(Contract F19628-76-C-0002; ARPA Order 512)
(AD-A050584; ESD-TR-77-246) Avail: NTIS HC A05/MF A01 CSCL 17/10

This report describes 21 investigations in the field of seismic discrimination. These are grouped as follows: surface-wave studies (6 contributions), studies of seismic scaling and body-wave magnitude mb (4 contributions), miscellaneous studies (5 contributions), and investigations related to data analysis and computer systems (6 contributions). Author (GRA)

N78-22530# Danish Meteorological Inst., Copenhagen. Geophysical Dept.
IONOSPHERIC RESEARCH USING SATELLITES Final Scientific Report, 1 Oct. 1976 - 30 Sep. 1977
Ib Steen Mikkelsen and Henrik Hartmann 2 Feb. 1978 6 p
(Grant AF-AFOSR-3149-77)
(AD-A050605; AFGL-TR-78-0043) Avail: NTIS HC A02/MF A01 CSCL 04/1

The total electron content (TEC) data taken during the period 7-14 November 1977 at Narssaq Point, Greenland using the ATS-5 satellite are presented and reviewed. During this time period a number of substorms were recorded on the local magnetometer, and the substorm effects on the TEC data are described. This is the terminal report on the satellite project at Narssaq Point. Author (GRA)

N78-22531# Observatorio del Ebro, Tortosa (Spain).
IONOSPHERIC ELECTRON PRODUCTION RATE FOR GRAZING INCIDENCE AT THE EBRO OBSERVATORY Final Report, Aug. 1973 - Jul. 1974
Luis F. Alberca 29 Dec. 1977 67 p refs
(Grant AF-AFOSR-2745-75)
(AD-A050606; AFGL-TR-78-0044; SR-6) Avail: NTIS HC A04/MF A01 CSCL 04/1

Values of total electron content of the ionosphere, obtained at the Observatorio del Ebro by the Faraday rotation method, have been analyzed to study electron production rates. Daily values of the electron production rate, integrated with respect to height through the ionosphere, were determined at sunrise

for the period August 1973 - Jul 1974, by a method that makes use of a two components model atmosphere. A Fourier analysis of the results indicates an annual and a semiannual variation of the production rate values. A comparison with results of other authors seems to indicate a latitudinal dependence of the semiannual variation; no similar effects were found for the annual variation. Author (GRA)

N78-22532# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

SIGNATURE OF A PARALLEL ELECTRIC FIELD IN ION AND ELECTRON DISTRIBUTIONS IN VELOCITY SPACE

Interim Report

Donald R. Croley, Jr., Paul F. Mizera, and Joseph F. Fennell 6 Feb. 1978 21 p refs

(Contract F04701-77-C-0078)

(AD-A050637; TR-0078(3960-5)-5; SAMSO-TR-78-38) Avail: NTIS HC A02/MF A01 CSCL 04/1

Charged particle data taken by the S3-3 satellite are presented as contours of the velocity distribution function on a velocity-space diagram. This report focuses on the analytical technique used to interpret the particle data. Details of features exhibited by the electron and ion data in the velocity space representations are discussed in terms of a simple electrostatic acceleration model. The observed particle populations are separated in velocity-space by recognizable demarcations calculated from the conservation laws in accordance with Liouville's theorem. GRA

N78-22533# Geological Survey, Denver, Colo.

GRID VALUES AND CHARTS FOR THE IGRF (INTERNATIONAL GEOMAGNETIC REFERENCE FIELD)

Final Report

D. R. Barraclough and E. B. Fabiano 1978 139 p

(PB-276630/1; USGS-GD-78-005) Avail: NTIS HC A07/MF A01 CSCL 08I

Grid values of the seven magnetic components on a five degree grid, values of total magnetic intensity on a two degree grid, and small scale charts of the main field and secular variations are presented. GRA

N78-22534# Bendix Field Engineering Corp., Grand Junction, Colo.

PRELIMINARY STUDY OF THE FAVORABILITY FOR URANIUM IN SELECTED AREAS IN THE BASIN AND RANGE PROVINCE, NEVADA

G. M. Cupp, S. H. Leedom, T. P. Mitchell, K. D. Kiloh, and R. C. Horton Oct. 1977 115 p refs

(Contract EY-76-C-13-1664)

(GJBX-74(77)) Avail: NTIS HC A06/MF A01

In the Virgin Valley area, the Canyon Rhyolite Formation contained as much as 27 ppM U3O8 and was an excellent source rock. Uranium deposits in the underlying Virgin Valley Formation were small but larger deposits may exist. The northern portion of the Reese River Valley contained several small uranium deposits but none of mineable grade or size. Rhyolitic volcanic rocks in the area contained above-average amounts of uranium, and larger deposits may lie beneath these potential source rocks. The East Walker River area may be part of a larger uranium province. Intrusive and extrusive rocks in the area contained above-average amounts of uranium and low-grade supergene deposits were found. Large areas of potential source rocks and host rocks, and two small uranium deposits, were found in the Coaldale area. Many rhyolite plugs were also found. The Carol R prospect was an isolated uranium occurrence in Tertiary lacustrine rocks. Uranium deposits in Meadow Valley were in the Panaca Formation, a Pliocene lacustrine formation of varied lithology. The uranium deposits were small and low grade. ERA

N78-22535# Battelle Pacific Northwest Labs., Richland, Wash.

SOILS OF THE PACIFIC NORTHWEST SHRUBSTEPPE: OCCURRENCE AND PROPERTIES OF SOILS ON THE ARID LAND ECOLOGY RESERVE, HANFORD RESERVATION

R. E. Wildung Jul. 1977 34 p refs

(Contract EY-76-C-06-1830)

(BNWL-2272) Avail: NTIS HC A03/MF A01

The soils of the Arid Land Ecology Reserve, encompassing the IBP Grassland Biome intensive study site on the ERDA Hanford Reservation, are representative of a larger geographical region including much of the Columbia Plateau and Pacific Northwest shrub-steppe. This results from a unique diversity in parent materials of mixed origin derived from the loess eolian, lacustrine and stream-laid material including glacial outwashes, river terraces, flood plains and alluvian fans, and meteorological factors accompanying a marked change in altitude within the Reserve resulting in development of soils over a range in temperature, moisture and vegetative regimes. The Reserve and the IBP Grassland Biome intensive study site serve as valuable, representative areas for the study of soil genesis and morphology in the shrub-steppe. The role of soils can be determined in basic environmental processes involving the flow of energy, cyclization of nutrients or the fate and behavior of pollutants. ERA

N78-22536# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

A DOUBLE LAYER REVIEW

Lars P. Block Jun. 1977 41 p refs Submitted for publication

(TRITA-EPP-77-16) Avail: NTIS HC A03/MF A01

A review of the main results on electrostatic double layers (sometimes called space charge layers or sheaths) obtained from theory, and laboratory and space experiments up to the spring of 1977 is given. Double layers are defined in terms of potential drop, electric field, and charge separation. Theoretical results obtained so far are reviewed. This covers among other things necessary criteria for existence and stability, quantitative estimates of charge separation and thickness, and some probable cause of DL-formation in terms of an instability. Next, experimental results obtained in the laboratory are compared with the theoretical results. Due to recent progress in experimental techniques the interior of a double layer can now be studied in greater detail than was possible before. By means of barium jets and satellite probes, double layers have now been found at the altitudes earlier predicted theoretically. The general potential distribution above the auroral zone, suggested by inverted V-events and electric field reversals, is corroborated. Author (ESA)

N78-22537# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).

THE INTERNATIONAL GRAVITY STANDARDIZATION NET 1971 (IGSN 71) IN THE FEDERAL REPUBLIC OF GERMANY (TRANSFORMATION OF THE GERMAN GRAVITY NET 1962 AND STATION DESCRIPTIONS OF IGSN 71) [DAS INTERNATIONAL GRAVITY STANDARDIZATION NET 1971 (IGSN 71) IN DER BUNDESREPUBLIK DEUTSCHLAND (TRANSFORMATION DES DEUTSCHEN SCHWERENETZES 1962 UND STATIONSBESCHREIBUNGEN DES IGSN 71)]

Werner Doerge, Ewald Reinhart, and Gerd Boedecker Bayerische Akad. der Wiss. 1977 61 p refs In GERMAN; ENGLISH summary

(Ser-B-225; ISBN-3-7696-8527-X) Avail: NTIS HC A04/MF A01

The parameters difference in reference level and scale are determined by least squares adjustment for the transformation between the German Gravity Net 1962 and the International Gravity Standardization Net 1971 (IGSN71). Gravity measurements were made at 111 referral stations for the comparison. A total of 79 sketches of IGSN71-stations in the Federal Republic of Germany are presented, updated to 1976. Author (ESA)

N78-22538# Interdepartmental Committee for Atmospheric Sciences, Washington, D.C.

INSTRUMENTATION AND MEASURING SYSTEMS FOR STRATOSPHERIC RESEARCH

Mar. 1977 24 p refs

(PB-277073/3; ICAS-20A) Avail: NTIS HC A02/MF A01 CSCL 04A

A summary of the state-of-the-art of atmospheric measurements, including the Dobson network, ultraviolet dosimeters for erythermal radiation, and stratospheric motion, is presented.M.V.

N78-22539# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

ANALYSIS OF THE RELATIONSHIP BETWEEN LF REFLECTION COEFFICIENTS AND D-REGION PROFILES

R. Michael Jones Nov. 1977 51 p refs
(PB-276387/8; NOAA-TM-ERL-WPL-29; NOAA-77120102)
Avail: NTIS HC A04/MF A01 CSCL 04A

In calculating D region electron density profiles from LF reflection coefficient measurements, it is important to order those measurements according to depth of penetration into the ionosphere. A ray theory analysis, a set of full-wave reflection coefficient calculations, and reflection coefficient measurements support the approximation that those waves with the larger equivalent frequency f(cos squared (i sub 0)) will penetrate further into the ionosphere. This approximation is more accurate for those waves that reflect below the height where the collision frequency equals the gyrofrequency where the earth's magnetic field has negligible effect. GRA

N78-22540# Geological Survey, Menlo Park, Calif. Office of Earthquake Studies.
PROCEEDINGS OF CONFERENCE 2: EXPERIMENTAL STUDIES OF ROCK FRICTION WITH APPLICATION TO EARTHQUAKE PREDICTION
Jack F. Evernden, ed. Apr. 1977 705 p refs Conf. held at Stanford, Calif., 28-30 Apr. 1977; under the auspices of Natl. Earthquakes Hazards Reduction Program
(PB-276627/7; USGS-GD-78-002) Avail: NTIS HC A99/MF A01 CSCL 08K

Various aspects of rock friction that have application to earthquake prediction are presented. A compilation of the criticism made at the conference during the presentation of the papers is also included. In addition, the proceedings contain a short note of each participant at the conference on the topics perceived to require further research. Two appendices are included which contain six papers that were not given at the conference but address various aspects of rock deformation both in laboratory experiments and on natural faults in the earth. GRA

N78-22412# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE SUPERGENE ZONE, PART 1
In its Geochem. of Elem. in the Supergene Zone 1977 p 1-39 refs (For availability see N78-22411 13-42)
Copyright. Avail: NTIS HC A12/MF A01

N78-22416 Karlsruhe Univ. (West Germany). Inst. fuer Geodaesie.
ON ESTIMATION OF THE DEGREE OF BEST FITTING POLYNOMIALS
Joachim Arnold *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 5-12 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-22417 Technische Universitaet, Hanover (West Germany). Inst. fuer Theoretische Geodaesie.
A METHOD OF DIRECT GRAVIMETRICAL DETERMINATION OF DIFFERENCES OF GEOID UNDULATIONS
Hermann Drewes *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Fed. Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 13-20 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

N78-22563# Israeli Program for Scientific Translations Ltd., Jerusalem.
SOLAR ACTIVITY AND CLIMATE
T. V. Pokrovskaya . *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 1-24 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

N78-22564# Israeli Program for Scientific Translations Ltd., Jerusalem.
SOLAR ACTIVITY AND CLIMATE
E. R. Mustel *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 25-52 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

N78-22570# Israeli Program for Scientific Translations Ltd., Jerusalem.
MANIFESTATIONS OF SOLAR ACTIVITY IN THE MAGNETOSPHERE AND IONOSPHERE
A. I. Ol *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 111-127 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-22541 Oklahoma Univ., Norman.
A GENETIC CLIMATIC CLASSIFICATION SYSTEM OF THE COTERMINOUS UNITED STATES AS PORTRAYED BY MEAN MONTHLY TEMPERATURE-PRECIPITATION CLIMOGRAPHS Ph.D. Thesis
Elias Johnson 1977 428 p
Avail: Univ. Microfilms Order No. 77-32866

Seven independent climatic controls were calculated for the purpose of seeking their significance as related to mean climographs for each climatic region. Test weather stations were used to empirically verify the a priori classification of first-order weather station data, to reposition various portions of boundary lines where a paucity of data exists, and to determine the realness of boundary lines, particularly where weather stations were closely spaced but were, in fact, classified into different climatic regions. Each mean climograph per climatic region was analyzed in detail with respect to the most significant and discriminating climatic controls. Climatic factors were related to mean climographs and rigorously analyzed to show the uniqueness of each climatic region. Furthermore, climatic factors and associative causes relative to similar features of mean climograph configurations were listed. Dissert. Abstr.

N78-22542 Utah Univ., Salt Lake City.
CLIMATIC EFFECTS OF CIRRUS CLOUDS Ph.D. Thesis
Kenneth Patrick Freeman 1977 166 p
Avail: Univ. Microfilms Order No. 78-03870

The atmospheric radiation budget was modeled with particular emphasis upon the scattering effects of clouds and aerosols, and the climatic effects of increasing cirrus cloudiness in the Northern Hemisphere were investigated with three models of enhanced cloudiness. Using a zonally averaged physical model of the atmosphere, the solar and terrestrial longwave components of the radiation and heat budgets of the earth-atmosphere system were computed and compared with earlier computations and satellite observations of the radiation budget parameters. The effects of a light background concentration of aerosols were tested in both the solar and infrared bands. The radiation budget computed matched the satellite observations of planetary albedo, absorption of solar radiation, and upwelling longwave flux more closely than did the earlier computed models. Dissert. Abstr.

N78-22543 Purdue Univ., Lafayette, Ind.
AN INVESTIGATION OF MULTIPLE VORTEX PHENOMENA IN TORNADO-LIKE FLOWS Ph.D. Thesis
John Thomas Snow 1977 394 p
Avail: Univ. Microfilms Order No. 78-03287

The occurrence of these multiple vortices in tornado-like swirling flows was hypothesized as being due to the development of an inertial instability in the cylindrical shear layer surrounding the central stagnant core of a two celled vortex. The validity of this hypothesis was examined by means of a simple linear stability analysis, and through a laboratory simulation. Through the linear stability analysis, it was found that there was indication that the most unstable mode of disturbance for a cylindrical swirling

flow was that due to an azimuthal, or cylinder symmetric, perturbation. A semicircle theorem for this type of disturbance was developed. The special case of the stability of a cylindrical flow with constant axial velocity and strongly sheared azimuthal velocity was solved in detail. Dissert. Abstr.

N78-22544 California Univ., Los Angeles.
RADIATION CLIMATES IN THE CONTERMINOUS UNITED STATES Ph.D. Thesis
Cort James Willmott 1977 269 p
Avail: Univ. Microfilms Order No. 7802762

Hourly synoptic and daily radiosonde information from daily totals of the main surface radiation budget terms, i.e., absorbed solar radiation, atmospheric counter radiation and terrestrial radiations, were simulated over the year by a comprehensive energy and moisture budget model. P-mode principle components analyses and a grouping algorithm were applied to the resultant annual radiation records in order to group the stations and/or identify radiation regimes or regions. The eight regimes which emerged and were mapped and otherwise described are (1) a seasonally humid mideastern regime, (2) a mildly seasonal southeastern regime, (3) a severe winter northeastern regime, (4) a dry south central regime, (5) a south central transitional regime, (6) a coastal regime, (7) a dry severe winter north central regime and (8) a dry upland desert regime. Dissert. Abstr.

N78-22545*# Environmental Research and Technology, Inc., Concord, Mass.
QUANTITATIVE MAPPING OF RAINFALL RATES OVER THE OCEANS UTILIZING NIMBUS-5 ESMR DATA Final Report, Jan. 1975 - Nov. 1976
Mirle S. V. Rao and William V. Abbott Nov. 1976 30 p refs (Contract NAS5-21908)
(NASA-CR-156738; P-516) Avail: NTIS HC A03/MF A01 CSCL 04B

The electrically scanning microwave radiometer (ESMR) data from the Nimbus 5 satellite was used to deduce estimates of precipitation amount over the oceans. An atlas of the global oceanic rainfall was prepared and the global rainfall maps analyzed and related to available ground truth information as well as to large scale processes in the atmosphere. It was concluded that the ESMR system provides the most reliable and direct approach yet known for the estimation of rainfall over sparsely documented, wide oceanic regions. Author

N78-22546# Finnish Meteorological Inst., Helsinki.
ON THE DIURNAL VARIATION OF HUMIDITY IN FINLAND
Raino Heino Nov. 1977 20 p
(ISBN-951-697-089-3; ISSN-0355-1733; TR-16) Avail: NTIS HC A02/MF A01

The main features of the diurnal course of humidity parameters are, for the most part, typical of similar areas. The mean diurnal variation of water vapour pressure has a single, small oscillation from October to March and a double oscillation from May to September. The diurnal variation of relative humidity has typical inversely correlated features to the diurnal course of temperature with respect to the times of occurrence of extreme values and the shape of the mean diurnal course. Some seldom presented humidity parameters, such as dew point temperature, specific humidity and saturation deficit are also illustrated as well as the extreme values of the humidity parameters. Author

N78-22547# Finnish Meteorological Inst., Helsinki.
A METEOROLOGICAL OBSERVATION SYSTEM FOR ROAD AND AVIATION METEOROLOGICAL RESEARCH
Goran Kari Nov. 1977 29 p refs
(ISBN-951-697-086-9; ISSN-0355-1733; TR-15) Avail: NTIS HC A03/MF A01

The observation station measured wind profiles, as well as air humidity and temperature profiles; it also measured temperature profiles in both road based constructions. The balances of both short wave and long wave radiation were measured over the road surface. The data from the micrometeorological station and supplementary standard meteorological data recorded automatically and manually were stored on magnetic tape. The system was designed to measure meteorological properties over a road surface, but it was also used in research into other meteorological phenomena. Author

N78-22548# Weather Wing (5th), Langley AFB, Va. Aerospace Sciences Div.
THE USE OF WIND STRATIFIED CONDITIONAL CLIMATOLOGY TABLES
Stephen M. Horn and Joseph J. Butchko Feb. 1978 19 p refs
(AD-A051036; Rept-5-WWTN-78-1) Avail: NTIS HC A02/MF A01 CSCL 04/2

This paper describes the design of computer produced Wind Stratified Conditional Climatology Tables and their use in short-range forecasting. Author (GRA)

N78-22549# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE 140-GHz ATTENUATION AND OPTICAL VISIBILITY MEASUREMENTS OF FOG, RAIN AND SNOW
Victor W. Richard, John E. Kammerer, and Richard G. Reitz Dec. 1977 83 p refs
(DA Proj. 1M3-62303-A-214; DA Proj. 1M1-61102-AH-43)
(AD-A051055; ARBRL-MR-2800) Avail: NTIS HC A05/MF A01 CSCL 20/14

The attenuation of fog, rain and snow has been measured at 140 GHz (2.1 mm wavelength) for rainfall intensities varying from drizzles up to 20 mm/hr and over a wide range of fog and snowfall intensities. Measured attenuation data are compared with theoretically derived attenuation data. Optical visibility and 140 GHz attenuation measurements were made simultaneously, providing comparisons between optical and millimeter wave system capabilities under degraded weather conditions. A brief review of the theoretical and experimental work of a number of authors on the computation and measurement of fog, rain, and snow attenuation at 140 GHz is presented. An extensive reference and bibliography list is given which includes a number of articles from Soviet open literature. GRA

N78-22550# South Carolina Univ., Columbia. Dept. of Geography.
SOUTH CAROLINA PRECIPITATION 1941-1970
Paul E. Lovingood, Jr. and John C. Purvis Dec. 1977 53 p refs Sponsored in part by South Carolina Water Resources Commission, Columbia
(PB-277519/5; NOAA-78010408) Avail: NTIS HC A04/MF A01 CSCL 04B

A brief overview is given of seasonal and annual precipitation distribution for South Carolina. In addition, the anomaly that exists in the average precipitation statistics for coastal South Carolina is also analyzed. The data used in this study are official National Weather Service rainfall normals. GRA

N78-22551# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
ATMOSPHERIC PRESSURE JUMPS MEASURED WITH ARRAYS OF SENSITIVE PRESSURE SENSORS IN THE VICINITY OF CHICAGO'S O'HARE INTERNATIONAL AIRPORT
A. J. Bedard, Jr. Oct. 1977 32 p refs
(PB-277518/7; NOAA-TM-ERL-WPL-28) Avail: NTIS HC A03/MF A01 CSCL 04B

An experiment designed to evaluate the use of arrays of sensitive pressure sensors for gustfront detection is described. First results of the experiment demonstrated the feasibility of predicting the motion of such density currents by using an array of such sensors. Using data sets obtained in June through August of 1976, implications for the design of arrays to provide warnings of gust front systems in airport environments are discussed. Although over 80% of the pressure jumps over the O'Hare system were tracked, several events went undetected at two or more of the outer array locations. It is therefore concluded that the optimum array density will involve a compromise between practicality and a need for high reliability in detection. GRA

N78-22552# National Weather Service, Silver Spring, Md.
WORLDWIDE MARINE WEATHER BROADCASTS. SECTION 1: RADIOTELEGRAPH BROADCASTS. SECTION 2: RADIOTELEPHONE BROADCASTS. SECTION 3: RADIO-

FACSIMILE BROADCASTS. SECTION 4: RADIOTELEPRINTER BROADCASTS. SECTION 5: WEATHER BROADCASTS FOR THE GREAT LAKES, CONTINUOUS BROADCASTS: NOAA WEATHER RADIO (VHF-FM)
Jul. 1977 129 p Prepared in cooperation with Naval Weather Service, Wash. D. C.
(PB-277403/2; NOAA-78011604) Avail: NTIS HC A07/MF A01 CSCL 04B

The booklet serves as a source of marine weather broadcast information. It is primarily for the use of U.S. naval and merchant ships, but is available to other ships. It contains information on marine weather broadcasts in all areas of the world where such service is provided. Sections 1 through 4 contain details of radiotelegraph, radiotelephone, radiofacsimile, and radioteleprinter transmission, respectively. The NOAA Weather Radio continuous broadcasts (VHF-FM) and Great Lakes marine broadcasts are listed in Section 5. In Sections 1 through 4 the broadcasts are arranged according to ocean areas. GRA

N78-22553# Toronto Univ. (Ontario). Cloud Physics Lab.
PROJECT SEVERE STORM MODELLING Final Report, Jul. 1976 - Jun. 1977
Roland List Oct. 1977 44 p refs
(Grant NOAA-04-6-022-44001)
(PB-277261/4; NOAA-77121903) Avail: NTIS HC A03/MF A01 CSCL 04B

A compilation of five papers makes up this report which reflects the studies made at the University of Toronto under the sponsorship of Project Severe Storms Modelling (NOAA). These are: Research on severe storms and hail formation; Thermodynamics of falling precipitation zones; Evolution of raindrop size distributions in steady state rainshafts; Evolution of raindrop spectra with collision-induced breakup; and a reply to comments on the latter. GRA

N78-22554# Chicago Univ., Ill.
UNIVERSITY OF CHICAGO CONTRIBUTION TO PROJECT METROMEX-II Final Technical Report, 29 Mar. 1972 - 30 Sep. 1977
Roscoe R. Braham, Jr. 15 Dec. 1977 108 p refs
(Grant NSF ENV-72-03399)
(PB-276957/8; UCHI-CPL-77-50) Avail: NTIS HC A06/MF A01 CSCL 04B

Measurements made in the vicinity of St. Louis, Mo. showed that this urban-industrial area exerts marked effects upon clouds and rainfall over and downwind of the city. Summaries of studies of condensation nuclei, cloud drop spectra, initiation of precipitation, ice forming nuclei, cloud growth, and the urban boundary layer are contained in this final grant report. GRA

N78-22555# Environmental Sciences Research Lab., Research Triangle Park, N.C.
NON-DIVERGENT WIND ANALYSIS ALGORITHM FOR THE ST. LOUIS RAPS (REGIONAL AIR POLLUTION STUDY) NETWORK
Terry L. Clark and Robert E. Eskridge Nov. 1977 72 p refs
(PB-276582/4; EPA-600/4-77-049) Avail: NTIS HC A04/MF A01 CSCL 04B

An objective wind analysis algorithm capable of producing non-divergent wind fields at up to ten levels in the atmospheric boundary layer for St. Louis, Missouri is described. Wind data collected during the St. Louis Regional Air Pollution Study and averaged over 15 minute intervals were used to construct u and v wind component fields on a 46 by 46 grid network with a grid spacing of 1 km via a mean-radius technique. The divergence across grid squares was minimized by a non-divergence algorithm. Several analyses produced by the algorithm are illustrated. A user's guide and computer program listing are included. GRA

N78-22556# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Analysis and Prediction Div.
DESCRIPTION OF THE GENERAL PROGRAM STRUCTURE OF THE THIRD-GENERATION NCAR GENERAL CIRCULATION MODEL
Richard K. Sato and Gerald L. Browning Dec. 1977 58 p refs
(Grant NSF ATM-77-23757)
(PB-276694/7; NCAR/TN-127+IA) Avail: NTIS HC A04/MF A01 CSCL 04B

A description of the design, implementation, and operation of the third-generation NCAR general circulation model is presented. Information needed by the scientist or programmer who intends to modify and/or run the model is given. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-22557*# Analytical Mechanics Associates, Inc., Jericho, N.Y.
TIDAL FREQUENCY ESTIMATION FOR CLOSED BASINS Final Report
J. B. Eades, Jr. 15 Feb. 1978 152 p refs
(Contract NAS5-22927)
(NASA-CR-156755; AMA-78-11) Avail: NTIS HC A08/MF A01 CSCL 08C

A method was developed for determining the fundamental tidal frequencies for closed basins of water, by means of an eigenvalue analysis. The mathematical model employed, was the Laplace tidal equations. Author

N78-22558# Naval Air Development Center, Warminster, Pa. Aerolectronic Technology Dept.
COMPUTER GENERATED RANDOM SEA SURFACES FOR USE WITH THE PROGRAM CABUOY Final Report
John P. Brett 30 Sep. 1977 27 p
(AD-A050818; NADC-77271-20) Avail: NTIS HC A03/MF A01 CSCL 08/3

Random sea surfaces representative of sea states 3 through 8 have been generated for use with the computer program CABUOY. Output waveforms are presented graphically, along with the frequencies, amplitudes, and phases of the component waves. Physical characteristics of the generated waveforms are compared with actual sea state data. Author (GRA)

N78-22559# British Columbia Univ., Vancouver.
THE DESIGN AND PERFORMANCE OF FREE-FALL MICROSTRUCTURE INSTRUMENTS AT THE INSTITUTE OF OCEANOGRAPHY, UNIVERSITY OF BRITISH COLUMBIA
Thomas R. Osborn Oct. 1977 59 p refs
(Contract N00014-76-C-0446)
(AD-A050877; IOUBC-MS-30) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report covers the design, manufacture, and operational characteristics of the four different types of free-fall microstructure instruments developed at the Institute of Oceanography of The University of British Columbia. The objective is to produce one comprehensive description of the four vehicles as a reference for readers of material based on the data collected by the instruments. Author (GRA)

N78-22560# British Columbia Univ., Vancouver. Inst. of Oceanography.
TURBULENT VELOCITY MEASUREMENT WITH AN AIRFOIL PROBE
Thomas R. Osborn and William R. Crawford Oct. 1977 61 p refs
(Contract N00014-76-C-0446)
(AD-A050878; IOUBC-MS-31) Avail: NTIS HC A04/MF A01 CSCL 14/2

The objective of this report is to have as complete a description as possible of the characteristics of the probe as seen now, and to make it available to the oceanographic community so that they can understand the system of measurement in use, and then interpret the results of the data taken. As will be noticed in reading this report, there are gaps in the present knowledge and the work in progress needed to fill these gaps is outlined. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-22561# Israeli Program for Scientific Translations Ltd., Jerusalem.
EFFECTS OF SOLAR ACTIVITY ON THE EARTH'S ATMOSPHERE AND BIOSPHERE
M. N. Gnevyshev, ed. and A. I. Ol, ed. 1977 304 p refs Transl. into ENGLISH of the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 Sponsored by US-Israel Binatl. Sci. Found.
(TT-75-50015; ISBN-0-7065-1566-8) Copyright. Avail: NTIS HC A14/MF A01

Solar-biological relationships effected through weather and the direct action of solar activity on living organisms are considered. Solar activity cycles and geomagnetic disturbances are correlated with the growth of tree stands, population dynamics among rodents, chemical test results, cardiovascular diseases, and mortality rates. For individual titles, see N78-22562 through N78-22581.

N78-22562# Israeli Program for Scientific Translations Ltd., Jerusalem.
INTRODUCTION TO EFFECTS OF SOLAR ACTIVITY ON THE EARTH'S ATMOSPHERE AND BIOSPHERE **c42**
M. N. Gnevyshev *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p v-xiv refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
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The hypothesis that solar activity affects the state of the lower layers of the atmosphere (the troposphere, which determines weather and climate) and also biological phenomena is introduced. The interrelationship of the upper and lower layers of the atmosphere, correlation of the state of the troposphere in the polar regions with solar activity and adaptability of organisms to environmental changes are among the factors discussed.
J.M.S.

N78-22563# Israeli Program for Scientific Translations Ltd., Jerusalem.
SOLAR ACTIVITY AND CLIMATE **c46**
T. V. Pokrovskaya *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 1-24 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
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The relationships between solar activity and the climatic regime and atmospheric circulation are discussed. Variations of certain meteorological and hydrological elements and in the curves of various indexes of atmospheric circulation are correlated with the 11 year sunspot cycle. The statistical reliability of the conclusions is examined. Specific problems in heliogeophysics are included.
J.M.S

N78-22564# Israeli Program for Scientific Translations Ltd., Jerusalem.
SOLAR ACTIVITY AND CLIMATE **c46**
E. R. Mustel *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 25-52 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
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Interactions between the sun and the earth's atmosphere determined by the sun's corpuscular activity are investigated with the aid of the statistical method of superimposed epochs (MSE). The statistical MSE curves, yielding the mean variation of the ground level atmospheric pressure as a function of time and the MSE curves based on the times the active regions pass through the central meridian of the sun are correlated. Maps showing the distribution of the signs of solar-atmospheric effects over the surface of the Northern Hemisphere are compared with synoptic maps for the same hemisphere, which indicate two basic types of atmospheric circulation. Evidence of a noticeable stream of IR emission the intensity of which increases with an increase in geomagnetic index is presented. It is concluded that the difference between the depth of penetration of IR emission into the stratosphere above continents and above oceans affects the degree of heating of the stratospheric layers, horizontal movements in the stratosphere, and the character of the atmospheric circulation.
J.M.S.

N78-22565# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE RELATIONSHIP BETWEEN SOLAR ACTIVITY, CLIMATE, AND THE GROWTH OF TREE STANDS **c43**
T. T. Bitvinskas *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 53-57 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauk Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

The dynamics of the growth of pines were studied as a function of the solar activity and a complex of climatic and soil ecological factors. Data of dendroscales for the main types of timber and the conditions of growth were compared with individual climatic elements. Composite climatic indicators were calculated, and the agreement between their dynamics and the growth in the stands of trees were studied. The temperature regime of the soil are shown to be the decisive and limiting factors determining the growth of forests stands. The closest correlation between the growth of stands of pine and solar activity data is obtained when the mean amplitudes of the fluctuations in the annual indexes for pine trees are compared with solar activity changes over 22 year cycles.
J.M.S.

N78-22566# Israeli Program for Scientific Translations Ltd., Jerusalem.
POPULATION DYNAMICS AND RHYTHMS OF EPIZOOTICS AMONG RODENTS CORRELATED WITH SOLAR CYCLES
A. A. Maksimov *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 58-73 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauk Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

Periodic, or cyclic, fluctuations in the population of rodents are examined in relation to solar activity cycles. The influence of habitat and ecology is discussed along with anthropogenic factors. Long-term forecasting and preventing of the spread of epizootic disease and destruction of agriculture and forestry are considered.
J.M.S.

N78-22567# Israeli Program for Scientific Translations Ltd., Jerusalem.
PERIODIC ACTIVITY OF NATURAL FOCI OF PLAGUE AND ITS CAUSES **c52**
A. A. Lavrovskii *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 74-81 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/Mf A01

Long-term data on the shifts of plague epizootics in the desert-plain and low-mountain-desert foci of the Caspian region, Kazakhstan, and Soviet Central Asia are analyzed and phases of low and high activity indicated. Mechanisms are examined which under favorable conditions set systems of biocenoses in motion and determine the active life of foci. Indirect dependence between the occurrence of plague epizootics in foci and solar activity is outlined. Long-term forecasts of plague epizootics are considered on a regional basis.
J.M.S.

N78-22568# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE EPIDEMIC PROCESS AS A FUNCTION OF SOLAR ACTIVITY **c52**
V. N. Yagodinskii, Z. P. Konovalenko, and I. P. Druzhinin *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 82-103 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i

Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

The characteristic features underlying the cyclicity of the epidemic process are discussed and compared with known indexes of solar cycles. Methods of autocorrelation-spectral analysis and periodogram analysis are used to analyze data concerning epidemic dynamics. Geographic and climatic conditions are among the factors considered. J.M.S.

N78-22569# Israeli Program for Scientific Translations Ltd., Jerusalem.
EFFECT OF HELIOGEOPHYSICAL FACTORS ON THE EVOLUTION OF INFECTIOUS DISEASES OF MAN c52
V. E. Stadolnik *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 104-110 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
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The effect of heliogeophysical factors on the biosphere, specifically on man and the diseases to which he is prone is discussed. Periodic rises of mortality and gravity for individual diseases are correlated with solar cycles. J.M.S.

N78-22570# Israeli Program for Scientific Translations Ltd., Jerusalem.
MANIFESTATIONS OF SOLAR ACTIVITY IN THE MAGNETOSPHERE AND IONOSPHERE
A. I. Ol *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 111-127 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

The physical processes causing magnetospheric and ionospheric disturbances and polar auroras are briefly described in terms of the effect of corpuscular solar radiation on the processes going on in the biosphere. Indexes of geomagnetic disturbances are given which can be used for comparison with various quantitative indexes characterizing biological phenomena. J.M.S.

N78-22571# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE BIOLOGICAL ACTIVITY OF THE DISTURBED GEOMAGNETIC FIELD
N. I. Muzalevskaya *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 128-137 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biospheru Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
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Specific features of the geomagnetic field (GMF) are described, as well as the peculiarities in the character of the response reactions at different levels of biological organization. It was shown that the energy density and the power flux density of the GMF at the time of a disturbance exceeds the sensitivity threshold of the human organism. On the basis of a comparison of the parameters of the threshold sensitivity and the disturbed GMF, proceeding from the general principles of reception, it is shown that an interaction between the human organism and the magnetic field of the earth is possible. The character of the reaction and the interaction of the GMF with the organism are investigated at the structural level. It is demonstrated that the first half of the phase of excitation of biological structures corresponds, on the indicated energy scale, to the position of the parameters of the disturbed GMF. The special features of the GMF are noted, from the point of view of a possible strengthening of the biological effect. Author

N78-22572# Israeli Program for Scientific Translations Ltd., Jerusalem.
POSSIBLE SOLAR-ACTIVITY FACTORS AFFECTING PROCESSES IN THE BIOSPHERE
B. M. Vladimirskii *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 138-154 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
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The manifestations of the effect of solar activity on biological processes are investigated. Topics discussed include: (1) phenomenological properties of signals connected with solar activity; (2) physical nature of the signal; (3) spectrum of natural alternating electromagnetic field of the earth and its variations; (4) biological effect of alternating electromagnetic field at frequencies below 200 Mc; and (5) nature of periodic correlations between solar activity and processes in the biosphere. It is concluded that the relationship between solar activity and processes in the biosphere is due to the alternating electromagnetic field, and that the effect of the field manifests itself in two frequency bands: acoustic frequencies and ultralow frequencies. The relevance of the results to space medicine is discussed. J.M.S.

N78-22573# Israeli Program for Scientific Translations Ltd., Jerusalem.
SOLAR ACTIVITY AND CHEMICAL TESTS c25
Giorgio Piccardi *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 155-163 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

Chemical tests, specifically the hydrolysis of bismuth chloride, were performed in order to study the relationship of test results to solar activity. Data were accumulated over a 16 year period and statistically analyzed. Results of the chemical tests indicate that they depend first and foremost on solar activity, including the effects of secondary phenomena originating at the earth as a result of solar activity, and the effects of industrial low frequency electromagnetic fields. The effects of sunspots, solar flares, and the anomalous events of 1958 and 1959 are discussed. Biological experiments carried out concurrently with the chemical tests established that biological tests are sensitive to solar activity. Biological and chemical test results are correlated and it is proposed to use inorganic chemical tests to model the biological effects of solar activity. J.M.S.

N78-22574# Israeli Program for Scientific Translations Ltd., Jerusalem.
A POSSIBLE MOLECULAR MECHANISM BY WHICH SOLAR ACTIVITY AFFECTS BIOSPHERE PROCESSES
L. D. Kislovskii *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 164-183 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
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The sensitivity of living organisms and of inorganic colloidal systems to the manifestations of solar activity, specifically to changes in low frequency electromagnetic fields, is associated with the nonequilibrium of these heterogeneous systems. Metastable states and their role in nature as discussed including the origin of metastable structures in water and the stabilization of metastable structures in water. Properties and use of activated water are briefly described with emphasis on the molecular mechanism of activation and effects of solar activity are outlined. Specific topics covered include: role of instantaneous changes in concentration of free calcium ions in biological systems; and effects of electromagnetic fields on biological systems. J.M.S.

N78-22575# Israeli Program for Scientific Translations Ltd., Jerusalem.
SOLAR ACTIVITY AND CARDIOVASCULAR DISEASES c52
K. F. Novikova and B. A. Ryvkin *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 184-200 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
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Biomedical data concerning the effect of solar activity on the origin, course, and outcome of major diseases of the cardiovascular system are presented. Specific topics covered

include: differences in incidence of cardiovascular diseases on quiet days and on days with geomagnetic disturbances; incidence of cardiovascular diseases and mortality as a function of intensity of geomagnetic disturbances; and effect of 11 year solar cycle on origin and outcome of cardiovascular diseases. J.M.S.

N78-22576# Israeli Program for Scientific Translations Ltd., Jerusalem.

SUDDEN DEATH FROM CARDIOVASCULAR DISEASES AND SOLAR ACTIVITY **c52**

M. N. Gnevyshev, K. F. Novikova, A. I. Ol, and N. V. Tokareva *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 201-210 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)

Copyright. Avail: NTIS HC A14/MF A01

The phenomenon of sudden cardiac death is discussed as a specific stress reaction of an unstable biological system to electromagnetic signals associated with an increase in solar activity. The pattern of solar activity, oscillations of 'bead' type terrestrial currents, and active longitudes in geomagnetic disturbances are considered in relation to sudden death from cardiovascular diseases. Because of the time lag of the human response to solar activity it is concluded that an early warning system of unfavorable cosmic and geomagnetic situations would be helpful in the prevention of cardiovascular deaths. J.M.S.

N78-22577# Israeli Program for Scientific Translations Ltd., Jerusalem.

SOLAR ACTIVITY AND THE VARIATION OF BLOOD COAGULATION BETWEEN 1949 AND 1966 **c52**

A. T. Platonova *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 215-217 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)

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A large-scale shift in the indexes of blood coagulation in the healthy and the sick noted in data accumulated between 1949 and 1966 is described. The data on coagulation time are compared with the magnitude of solar activity, as characterized by the sunspot area on the entire solar disk. Results are given. Author

N78-22578# Israeli Program for Scientific Translations Ltd., Jerusalem.

THE INFLUENCE OF SOLAR ACTIVITY ON THE FIBRINOLYTIC SYSTEM OF THE BLOOD **c52**

E. D. Rozhdestvenskaya and K. F. Novikova *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 218-223 ref Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)

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The fibrinolytic activity in patients suffering from rheumatic vitium cordis was examined. Several mutually complementary biochemical methods were used along with methods of studying the activity of the fibrin-stabilizing factor and tolerance of the tibrin clot for plasmin. An analysis of the data revealed wide variations in the indexes of fibrinolysis in the same patient. A waveform character of alternation of phases of activation and suppression of fibrinolysis with periods of 7-9-11 days were observed. The indexes of fibrinolytic activity were compared with geomagnetic indexes obtained during the 27 day period of solar activity. Results indicate that a rise in the geomagnetic disturbance level increases the probability of thrombogenesis. J.M.S.

N78-22579# Israeli Program for Scientific Translations Ltd., Jerusalem.

THE MECHANISM OF THE INFLUENCE OF SOLAR-ACTIVITY OSCILLATIONS ON THE HUMAN ORGANISM **c52**

A. Osipov and V. P. Desyatov *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 232-237 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)

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The effect of solar activity on mortality and the human nervous system is considered. Cases of sudden death in infants due to lung pathology and in adults due to hypertension and atherosclerosis and the occurrence of automobile accidents are correlated with fluctuations in solar activity. It is found that the increase in mortality and in the number of automobile accidents on days of chromospheric flares and magnetic storms is statistically significant. J.M.S.

N78-22580# Israeli Program for Scientific Translations Ltd., Jerusalem.

AN EXPERIMENTAL STUDY OF THE ULTRALOW-FREQUENCY ELECTROMAGNETIC FIELDS ON WARM-BLOODED ANIMALS AND MICROORGANISMS

B. M. Vladimirskii, A. M. Volynskii, S. A. Vinogradov, Z. I. Brodovskaya, N. A. Temuryants, Yu. N. Achkasova, V. D. Rozenberg, and V. D. Chelkova *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 259-269 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Bioferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)

Copyright. Avail: NTIS HC A14/MF A01

The influence of solar activity on the earth's biosphere through variations in the strength of alternating electromagnetic fields (AEF) was investigated. Eleven animals were irradiated 10 times and then killed by air embolism for anatomicopathological examination. In all the animals investigated there was a change in systolic rhythm, as well as in bioelectrical phenomena in the heart characterizing changes in the system producing excitation in the heart. Dynamic changes occurred in the electrical activity of the cortex and distinctive dynamic changes in the blood. Under the influence of AEF's, PO was found to be inactivated, the degree of inactivation of the enzyme depending on the field strength. Anatomicopathological examinations revealed some destructive changes in the heart and lung tissues. Microorganisms reacted to AEF's by more intensive multiplication and nonhereditary changes of morphological and cultural properties. It is noted that the discovered effects of AEF action correspond qualitatively to the effects observed during magnetic storms of sudden onset. Author

N78-22581# Israeli Program for Scientific Translations Ltd., Jerusalem.

TABLES OF SOLAR AND GEOPHYSICAL INDEXES **c92**

In its Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 270-290 Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)

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The mean-annual relative sunspot numbers (Wolf numbers) in the Zurich system for 1749-1968 are given along with the diurnal values of the flux of radio emission from the solar corona at a frequency of 200 Mc (wavelength 1.5 m) from 1954 to 1967, according to data of the Quarterly Solar Bulletin published in Zurich. The mean-diurnal values of the planetary index of the geomagnetic disturbance level for 1954-1969 are presented. Author

N78-22582 Drexel Univ., Philadelphia, Pa.

MAXIMUM EXPIRATORY FLOW, DIFFUSION AND CO2 ELIMINATION DURING LIQUID VENTILATION **Ph.D. Thesis**

Peter Arthur Koen 1978 152 p

Avail: Univ. Microfilms Order No. 78-05649

Maximum expiratory flow (V sub max) and diffusion space were measured (V sub diff) in cats during fluorocarbon ventilation. Maximum CO2 elimination was determined from these rate limiting factors. Results support the conclusion that (1) CO2 elimination during liquid breathing is both diffusion and ventilation limited; (2) that liquid breathing can support the metalbolic needs of an adult cat at twice its resting level; and (3) that the lung during liquid ventilation can be modeled as a linear resistance element with flow saturation at V sub max. Dissert. Abstr.

N78-22583 Northwestern Univ., Evanston, Ill.
MODELLING OF OXYGEN AUTOREGULATION IN CANINE SKELETAL MUSCLE Ph.D. Thesis
Howard Edgar Guthermann 1977 301 p
Avail: Univ. Microfilms Order No. 78-05272

A model was developed which could predict the change in active control systems, except the arteriolar flow control, given known changes in the arterial input and venous output to and from the muscle. The model takes into account the following phenomena thought to affect oxygen transport: extracapillary vascular hemodynamics, microvascular decreases in local hematocrit (the Fahraeus effect), and local tissue storage of oxygen as oxymyoglobin. Overall blood flow did not change significantly during hyperoxia, justifying the omission of the precapillary resistance control from the model when hyperoxic changes were employed. Dissert. Abstr.

N78-22584 Johns Hopkins Univ., Baltimore, Md.
MATHEMATICAL MODEL OF THE VESTIBULOOCULAR REFLEX Ph.D. Thesis
Kee Soon Chun 1977 250 p
Avail: Univ. Microfilms Order No. 78-06243

This model included quick phases and also dealt with the stochastic behavior of quick phase timing and amplitude. The structure of the model was consistent with recent findings of neurophysiology. The positions to which and from which quick phases move the eye were injected into the model at neurophysiologically appropriate locations in such a way that the variances of these signals, and correlation between them computed from the model, were similar to those obtained from the cat. Dissert. Abstr.

N78-22585*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RAPID, QUANTITATIVE DETERMINATION OF BACTERIA IN WATER Patent Application
Emmett W. Chappelle, Grace L. Picciolo, Richard R. Thomas (Boeing Co., Seattle), Eldon L. Jeffers (Boeing Co., Seattle), and Jody Deming, inventors (to NASA) (Hahnemann Hospital) Filed 20 Mar. 1978 40 p
(NASA-Case-GSC-12158-1; US-Patent-Appl-SN-888434) Avail: NTIS HC A03/MF A01 CSCL 06I

The methods and apparatus for the quantitative determination of bacteria in salt or fresh water, sewage effluent, drinking supply water, or estuaries are presented. A synthetic polymer hollow fiber filter/concentrator was employed to concentrate bacteria in a water sample by forcing the water across a filter or by recirculating the water through the filter to remove the filtrate. A bioluminescent assay for making a quantitative determination of water borne bacteria was provided. Systems are presented for automating the assays. NASA

N78-22586*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD AND APPARATUS FOR CONTINUOUS MEASUREMENT OF BACTERIAL CONTENT OF AQUEOUS SAMPLES Patent Application
Eldon L. Jeffers (Boeing Aerospace, Houston, Tex.), Reuben E. Taylor, Grace L. Picciolo (Food and Drug Admin.), Richard R. Thomas (Boeing Aerospace, Houston, Tex.), and Emmett W. Chappelle, inventors (to NASA) Filed 29 Mar. 1978 41 p
(NASA-Case-MSC-16779-1; US-Patent-Appl-SN-891247) Avail: NTIS HC A03/MF A01 CSCL 06I

The methods and apparatus for automatically and continuously making quantitative determinations of the bacteria present in water samples such as waste water, effluent or fresh water are presented. A bacteria adenosine triphosphate was used to determine the number of live bacteria present and the iron porphyrin assay to determine the total number of bacteria alive and dead present in the sample. NASA

N78-22587*# National Aeronautics and Space Administration. Pasadena Office, Calif.
BIOCONTAMINATION AND PARTICULATE DETECTION SYSTEM Patent Application
Jacqueline M. Jacobs, inventor (to NASA) (JPL) Filed 24 Feb. 1978 14 p
(Contract NAS7-100)
(NASA-Case-NPO-13953-1; US-Patent-Appl-SN-880727) Avail: NTIS HC A02/MF A01 CSCL 06M

A method for determining the characteristics and amount of microscopic contaminants lodged on a photographed surface was investigated. An image enhanced full color photographic negative and print were taken of the contaminated surface. Three black and white prints were developed subsequently from red, green, and blue separation filter overlays of the color negative. Both the color and three monochromatic prints were then scanned to extract in digital form a profile of any contaminant possibly existing on the surface. The resulting profiles were electronically analyzed and compared with data already stored relating to the known contaminants. NASA

N78-22588*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD AND AUTOMATED APPARATUS FOR DETECTING COLIFORM ORGANISMS Patent Application
Reuben E. Taylor, W. Preston Dill (Boeing Co., Houston, Tex.), and Eldon L. Jeffers, inventors (to NASA) (Boeing Co., Houston, Tex.) Filed 4 Apr. 1978 36 p
(Contract NAS9-13333)
(NASA-Case-MSC-16777-1; US-Patent-Appl-SN-893657) Avail: NTIS HC A03/MF A01 CSCL 06C

Method and apparatus are presented for automatically making periodic quantitative determinations of coliform organisms present in water such as waste water, effluent or fresh water by using electrochemical techniques based on detection of metabolic hydrogen liberated by the coliform organisms utilizing changes in electrode potentials. NASA

N78-22589*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WATER QUALITY MONITORING SYSTEM Patent Application
Reuben E. Taylor, Richard R. Brooks (Boeing Co., Houston, Tex.), Gerald D. Poel (Boeing Co., Houston, Tex.), Eldon L. Jeffers (Boeing Co., Houston, Tex.), and Arthur T. Linton, inventors (to NASA) (Boeing Co., Houston, Tex.) Filed 4 Apr. 1978 29 p
(Contract NAS9-13333)
(NASA-Case-MSC-16778-1; US-Patent-Appl-SN-893648) Avail: NTIS HC A03/MF A01 CSCL 06C

Methods and apparatus are presented for automatically and rapidly performing electrical, chemical, and biological assays for continuous monitoring water quality at a water treatment plant to ascertain the effectiveness of the treatment during the process flow. The invention is transportable in order that a single system may be utilized to service a number of separate or remote wastewater processing facilities. NASA

N78-22590*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLUID SAMPLE COLLECTION AND DISTRIBUTION SYSTEM Patent Application
Richard R. Brooks, inventor (to NASA) (Boeing Co., Houston, Tex.) Filed 4 Apr. 1978 21 p
(Contract NAS9-13333)
(NASA-Case-MSC-16841-1; US-Patent-Appl-SN-893382) HC A02/MF A01 CSCL 06C

Methods and apparatus are presented for automatically and continuously collecting samples from any one of a plurality of sampling points, filtering part of the samples collected and delivering both unfiltered and filtered samples to various analyzing sensors in order to determine the quality of the aqueous supply from which the sample is taken through various electrical, chemical, and biological means. NASA

N78-22591# Bureau of Radiological Health, Rockville, Md.
SYMPOSIUM ON BIOLOGICAL EFFECTS AND MEASUREMENT OF RADIO FREQUENCY/MICROWAVES
DeWitt G. Hazard, ed. Jul. 1977 399 p refs Conf. held at Rockville, Md., 16-18 Feb. 1977 Prepared in cooperation with World Health Organ., Geneva, Switzerland
(HEW-Publ-(FDA)-77-8026) Avail: NTIS MF A01; SOD HC

Engineers and scientists met and collectively discussed their problems and how they interface with one another. The symposium was divided into the following sessions: (1) Behavior Effects; (2) Physical Measurement; (3) Growth and Development; (4)

Nervous System Effects; (5) Occupational and Ocular Effects, with papers presented at each session. For individual titles, see N78-22592 through N78-22617.

N78-22592# Randomline, Inc., Huntingdon Valley, Pa.
BEHAVIORAL EFFECTS OF ELECTROMAGNETIC ENERGY **c53**
Allan H. Frey *In* Bur. of Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 11-22 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

The results of two lines of investigation are presented. In one, the effect of exposure to electromagnetic energy on irritability and aggression in mammals is detailed. It was found that electromagnetic energy exposure elicits a 'docility' response in a pain induced aggression situation. In the other series of experiments, it was found that exposure to electromagnetic energy adversely affects motor coordination or balance in the task of balancing on a rotating rod. Author

N78-22593# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.
FREE-OPERANT AVOIDANCE AND ESCAPE FROM MICROWAVE RADIATION **c53**
John C. Monahan and W. W. Henton *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 23-33 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

The purpose of the present investigation was to determine the stimulus properties of microwaves in a free-operant avoidance-escape paradigm. Experimental subjects received microwaves plus tone and sham subjects received tone only. During the session, all subjects could make responses by interrupting a light beam which passed through the animal holder. If no response was made, then the tone remained on for the entire session. The data show a clear difference in response patterns between experimental and control subjects both in frequency and variability of responding. Furthermore, experimental subjects could be categorized by their response patterns into escape animals, avoidance animals, and mixed response animals. These data show that microwave radiation can serve as a noxious stimulus which will maintain an active instrumental avoidance or escape behavior over repeated experimental sessions. Author

N78-22594# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.
MICROWAVE ABSORPTION AND TASTE AVERSION AS A FUNCTION OF 915 MHz RADIATION
J. C. Monahan and W. W. Henton *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 34-40 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

Thirty-two rats were divided into four subgroups and exposed to 915 CW radiation at different intensities immediately following 15 minutes access to a 10 percent sucrose solution. Absorption of microwave energy was relatively unchanged throughout a 15-minute exposure to forward power of 5.0 W. Microwave absorption progressively decreased during exposure at forward power levels of 9.1 and 19.0 W. Each subject was again given access to sucrose 24 hours later, with no indication of a conditioned taste aversion. Author

N78-22595# California Univ., Los Angeles. Environmental Neurobiology Lab.
BEHAVIORAL PROTOCOLS AND PRELIMINARY OBSERVATIONS OF CHICKS EXPOSED TO WEAK AMPLITUDE MODULATED 450 MHz FIELDS
R. G. Medici and P. M. Sagan *In* Bur. of Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 41-53 refs Sponsored in part by HEW and ONR (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

A series of studies has been designed to assay the behavioral effects of weak amplitude modulated VHF in neonatal chicks and wild mallard ducklings. This programmatic approach will be three dimensional: (1) across power levels, (2) across biologically relevant and non-relevant frequencies, (3) across increasingly complex time-based schedules of reinforcement. Preliminary studies at 5 mW/sq cm2 with amplitude modulation set at 3 Hz or 16 Hz were done with an FT 30 sec (fixed time schedule of reinforcement). Results suggest that simple activity measures are inadequate assays of possible weak effects whereas latency measures are sensitive to the presence of the field. Author

N78-22596# Veterans Administration Hospital, Kansas City, Mo. Labs. of Experimental Neuropsychology.
MICROWAVE HYPERTHERMIA AND VISUALLY EVOKED POTENTIALS: PRELIMINARY OBSERVATIONS OF GUINEA PIGS
Don R. Justesen and Virginia BruceWolfe (Kansas Univ., Kansas City) *In* Bur. of Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 54-61 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

Latencies of an early component (N1) of the Visually Evoked electrocortical Response (VER) of guinea pigs were observed as a function of body temperature as elevated by brief exposures to intense 2450-MHz microwave radiations. A curvilinear relation obtained in which the N1 latency decreased as temperature fell from 41 to 39.5 C, then increased as body temperature continued to fall to 38 C was examined. The temperature for optimal rates of neural processing of sensory information may therefore be 1 to 2 C above that of the resting norm. Data from other studies indicate that elevations of body temperature to 39-40 C occur to novel stimuli and other sources of emotional provocation. The inverted U-function, if a valid reflection of the normal relation between body temperature and neural activity, can be taken as evidence for an adaptive role of the 'psychogenic fever' that attends behavioral hyperarousal. Author

N78-22597# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.
INTERACTION BETWEEN MICROWAVE AND NEUROACTIVE COMPOUNDS **c53**
W. D. Galloway and Morris Waxler *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 62-69 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

Microwave radiation can produce an alteration in the behavior of an irradiated organism. It is commonly asserted that such behavioral effects are the result of a direct action by microwaves on some unspecified aspect of the central nervous system. However, the data to support such an assertion are weak. A study is reported which attempts to elucidate a neurotransmitter-linked mechanism of microwave action. Author

N78-22598# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
BROADBAND MEASUREMENTS OF DIELECTRIC PROPERTIES
Mays L. Swicord *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 71-80 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

An appropriate quantity to be measured is the dielectric constant; appropriate for two reasons. First, most techniques of dielectric constant measurement inherently take into account the geometry and resulting resonances of the sample holder. In fact, such resonances are purposefully created. Secondly, the dielectric constant, from which the propagation constant can be determined, yields more information. Namely, the real as well as the imaginery part of the propagation constant. Not only for the possible determination of selective absorption processes of various biomaterials but for convenience in routine dielectric constant measurements, a method suitable for measurement of complex dielectric constants over a frequency range of 0.5 to 18 GHz was developed. Dielectric constant values from 1 to 50 with a loss tangent of as much as 0.5 are measured with an accuracy dependent only on the sensitivity of the particular system used. Author

N78-22599# Washington Univ., Seattle. Bioelectromagnetics Research Lab.
QUANTITATION OF MICROWAVE BIOLOGICAL EFFECTS **c52**
Chung-Kwang Chou and Arthur W. Guy *In* Bur. of Radiol. Health

Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 81-103 refs (For availability see N78-22591 13-51)
(Grants FD-00646; CA-05681-01)
Avail: NTIS MF A01; SOD HC

While emphasizing dosimetry and instrumentation, we have been able to demonstrate that the effects of acute exposure to CW microwaves on some of the electrophysiological properties of the nervous system are thermal in nature. Studies on the microwave auditory effect have provided strong evidence that the mechanism of microwave hearing is electromechanical in nature. Development of a chronic exposure system and carbon EEG electrodes will provide a means for other researchers in pursuing the studies of biological effects of low level chronic exposure of microwaves. In this reported research, the quantitation of microwave biological effects is stressed so that extrapolation to humans is possible. Author

N78-22600# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.

NEAR-FIELD MEASUREMENTS OF RF FIELDS c32

Paul S. Ruggera *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 104-116 ref (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

The majority of electronic products that emit electromagnetic radiation (EM) to which the general public is inadvertently exposed operate at frequencies below 500 MHz. For the purposes of this paper, the radio frequency (RF) portion of the spectrum will be considered to extend from 1 MHz to 500 MHz. Some of the products for which no emission limits exist, or which are limited by the F.C.C. for reduction of their interference potential to communication systems are as follows: Citizen Band Radios; Induction Heaters (Sealers); Electrosurgical Units; Wireless Intercoms; Walkie-Talkies; Wireless Microphones; Security Transmitters; Intrusion Detectors; Field Disturbance Sensors; Door Opener Transmitters; Model Remote Control Transmitters; Amateur Radio Transmitters; Epillators; Electronic Games; Class I TV devices (couple to TV set with modulated RF oscillator); Master Antenna Systems; Ignition Systems; and Light Dimmers. Three of these exemplify the general problem and have been investigated by the Bureau of Radiological Health. These are: Radio Frequency Sealers; Electrosurgical Units, and Citizen Band Radios. A description of each of these, along with the data obtained in the near field are presented. Author

N78-22601# Maryland Univ., College Park. Inst. for Physical Science and Technology.

ELECTRIC FIELD MEASUREMENTS WITHIN BIOLOGICAL MEDIA c52

A. Y. Cheung *In* Bur. of Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 117-135 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

Analysis employing transmission line model of buried antenna as well as insulated dipoles was performed over the 0.9 to 10 GHz range. The antenna impedance modification as a result of interaction with the surrounding media was computed for a wide range of dielectric parameters typical of various biological materials, over a range of ambient temperatures. It was demonstrated analytically and experimentally that for deep implantation in muscle, relatively little change in probe response occurs with respect to the free space response of the probe over the frequency range of 0.915 GHz to 2.45 GHz. In addition, when in very close proximity to the muscle-fat or the worst case, muscle-air boundary, no significant change occurs in probe response because of dipole impedance variations. Calibration for electric field detection within muscular tissues has also been performed. Author

N78-22602# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.

INTERNAL DOSIMETRY AND EXTERNAL MICROWAVE FIELD MEASUREMENTS USING MINIATURE ELECTRIC FIELD PROBES c35

Howard Bassen *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 136-151 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

An optically-linked EM probe system was developed to meet the needs of researchers investigating UHF and microwave emissions from electronic products. It allows one to assess exposure levels accurately in biological effects studies conducted in this frequency range. The fiber optically-linked telemetry system provides RFI immunity and enhances accuracy below one GHz, by eliminating cable scatter. The probe system was developed for specialized laboratory measurements where present probes were not appropriate due to their physical size or hard wired readout. A detailed example was presented in which the system was used at 450 MHz as a field mapping device to evaluate an animal exposure chamber. Fields within simulated and actual biological specimens were measured with the above probe. A smaller version of the probe was discussed which can provide a practical means of measuring internal fields in living exposed to external electromagnetic radiation. Author

N78-22603# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.

INFRARED EMITTANCE OF ELECTROMAGNETIC PHANTOM MATERIALS AND INFRARED TRANSMITTANCE OF POLYETHYLENE c34

T. C. Cetas (Arizona Univ., Tucson) and G. Kantor *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 152-169 refs (For availability see N78-22591 13-51)
(Contract FD-03189-76-J; Grant CA-17343-01)
Avail: NTIS MF A01; SOD HC

Methods of obtaining quantitative thermometric data with a thermographic camera are discussed. These include the assessment of errors associated with the camera itself and of difficulties arising from the nature of the object to be measured. The latter refer to determinations of the penetration of depth of infrared radiation emitted by the object; measurement of the transmittance of windows in front of the objects; and measurement of the object's emittance under somewhat adverse circumstances. Finally, an example of a temperature measurement is given. Practical considerations of thermometry are emphasized as opposed to radiometric measurements. Examples are drawn from measurements involving tissue-equivalent electromagnetic phantom materials. Author

N78-22604# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.

A FINITE ELEMENT TECHNIQUE FOR CALCULATING INDUCED INTERNAL FIELDS AND POWER DEPOSITION IN BIOLOGICAL MEDIA OF COMPLEX IRREGULAR GEOMETRY EXPOSED TO PLANE WAVE ELECTROMAGNETIC RADIATION c52

Stanley M. Neuder *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 170-190 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

Computer programs were developed and utilized for calculating and graphing externally scattered and internally induced microwave fields in biological tissue. Results of calculations on a spherical multilayered model of the head and an irregularly shaped multilayered thigh model will be shown. Author

N78-22605# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.

COMPARISON OF CALCULATED ABSORBED DOSE RATE DISTRIBUTIONS IN PHANTOM HEADS EXPOSED TO 2450 MHz AND 915 MHz PLANE WAVE AND SLOT SOURCES c52

Henry S. Ho *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 191-200 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

The deeper penetration due to the plane wave source exposure, contrasting the tenfold larger maximum absorbed dose rate due to slot source exposure, illustrates the vast difference in energy absorption patterns due to these two types of sources for both the 915 MHz and 2450 MHz source frequencies. An increase in penetration depth with increased slot width was noted for both source frequencies, while a change in source frequency from 2450 MHz to 915 MHz does not greatly change the penetration depth for a given slot size. Author

N78-22606# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.

CHANGE IN AVERAGE ABSORBED DOSE RATE OF A GROUP OF MICE UNDER REPEATED EXPOSURE TO 915 MHz MICROWAVE RADIATION

Henry S. Ho, Frieda Pinkavitch, and William P. Edwards *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 201-215 refs (For availability see N78-22591 13-51)

Avail: NTIS MF A01; SOD HC

Two groups of mice were irradiated eight hours per day during alternate working days of the week for a total period of two months. The air temperature, relative humidity, and air flow rate in the waveguide were 20-28 C, 40-50 percent and 37 liters/min respectively. For a forward power of 5W which resulted in an averaged absorbed dose rate of approximately 5 mW/g, a reduction of energy absorption after the first hour of each session was observed throughout the experiment for both groups of animals. A lower average absorbed dose rate was also observed for the first several sessions of the irradiation, compared to those of the remaining sessions. The result indicates possible problems in dosimetry determination for animal irradiation apparatus where parameters for the determination of average absorbed dose rate are not monitored during the irradiation. Author

N78-22607# New York Univ. Medical Center. Inst. of Environmental Medicine.

THE DESCRIPTION OF A SYSTEM TO IRRADIATE CELLS IN CULTURE WITH MICROWAVES

James R. Rabinowitz, Robert B. Olcerst, and W. W. Mumford *In* Bur. of Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 216-229 refs Sponsored in part by the Navy (For availability see N78-22591 13-51)

(Grants FD-00668; ES-00260)

Avail: NTIS MF A01; SOD HC

The need for identifying the biomolecular systems affected by microwave is discussed. A system for irradiating cultured cells or other biological samples is described. A formalism for treating the biological response in this system is introduced and analyzed. The effect of the temperature distribution within the sample on the biological response is illustrated for glucose efflux from red blood cells and ATPase activity. Author

N78-22608# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.

NEW TYPES OF MICROWAVE DIATHERMY APPLICATORS: COMPARISON OF PERFORMANCE WITH CONVENTIONAL TYPES c52

G. Kantor *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 230-249 refs (For availability see N78-22591 13-51)

(Grant FD-00790-0)

Avail: NTIS MF A01; SOD HC

Heating patterns induced in planar phantoms of simulated fat and muscle by direct contact applicators and by spaced applicators were compared. The new applicators provide for more uniform heating in the center of the temperature profiles than the conventional types presently in general clinical use. Unwanted irradiation of operator and unprescribed tissue of patient is much more easily controllable with direct contact applicators than with spaced applicators. Electric field measurements show that the leakage radiation of a commercially available direct contact applicator is less than 5 mW/sq. cm. 2 per 100 Watts of forward power at a spacing of 5 cm from the aperture-phantom boundary while scattered field levels for loaded spaced applicator can typically be 30 mW/sq. cm. 2 per 100 Watts of forward power at a distance of 13 cm in front of the aperture. Author

N78-22609# Rochester Univ., N. Y. Non-ionizing Radiant Energy Facility.

NEUROENDOCRINE RESPONSES IN THE RAT AND DOG EXPOSED TO 2450 MHz (CW) MICROWAVES

Sol M. Michaelson, Ronnie Guillet, W. Gregory Lotz, Shin-Tsu Lu, and Richard L. Magin *In* Bur. of Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 263-279 refs Sponsored in part by Navy and DOE (For availability see N78-22591 13-51)

(Contract FD-74-111)

(UR-3490-1080) Avail: NTIS MF A01; SOD HC

Changes in endocrine function and hormone levels occur in rats and dogs acutely exposed to certain power density/time durations of 2450 MHz (CW) microwaves. Such effects were of a transient nature and are related to temperature increases of the individual gland or hypothalamic-hypophyseal responsiveness as a result of increased body temperature. Power density of 20 to 30 mW/sq cm seems to be a transitional range for stimulation of pituitary-adrenal activation in the rat. Author

N78-22610# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.

THE EFFECT OF REPETITIVE PRENATAL LOW-LEVEL MICROWAVE EXPOSURE ON DEVELOPMENT IN THE RAT

Moris L. Shore, Richard P. Felten, and Anthony Lamanna *In its* Symp. on Biol. Effects and Meas. of Radio. Freq./Microwaves Jul. 1977 p 280-289 refs (For availability see N78-22591 13-51)

Avail: NTIS MF A01; SOD HC

Rats were exposed to low level 2450 MHz microwave radiation daily for 5 hours from day 3 through day 19 of gestation at an average exposure level of 10 mW/sq cm 2. Exposed animals were positioned reproducibly in a square configuration so that 12 animals were parallel to the electric vector of the microwave field and 12 animals were parallel to the magnetic vector of the field. Following sham or microwave exposure, animals were allowed to deliver normally. Body and brain weight were determined on day 2, 3, 6, 7, 8, 9, 14, and 15 postpartum and were consistently lower control values for exposed animals oriented parallel to the electric vector of the microwave field. Author

N78-22611# George Washington Univ. Medical Center, Washington, D.C.

LIGHT AND ELECTRON MICROSCOPIC OBSERVATIONS ON THE BLOOD-BRAIN BARRIER AFTER MICROWAVE IRRADIATION

Ernest N. Albert *In* Bur. Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 294-304 refs (For availability see N78-22591 13-51)

Avail: NTIS MF A01; SOD HC

Chinese hamsters were irradiated with microwaves at 2450 MHz and power density of 10 mW/sq cm 2 for 2 and 8 hours for 1 day. Control animals were sham irradiated. Following irradiation the animals were anesthetized and treated for gross, and microscopic light and electron, examination. Brain slices were scored for peroxidase leakage. Subsequent to embedding, semi-thin sections were cut and observed with dark field and bright field microscopy as well as electron microscopy. Author

N78-22612# California Univ., Los Angeles. Environmental Neurobiology Lab.

CALCIUM BINDING IN CEREBRAL TISSUE c52

Suzanne M. Bawain and W. Ross Adey *In* Bur. Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 305-313 refs (For availability see N78-22591 13-51)

(Contracts N00014-69-A-0200-4037; F44620-75-C-0030; Grant FD-678)

Avail: NTIS MF A01; SOD HC

Possible effects of weak, extremely low frequency and amplitude modulated radio frequency fields on the calcium exchange between freshly isolated nervous tissue and a bathing physiological solution were investigated. Experimental results indicate that cerebral tissue responds to field stimulations contained within amplitude and frequency windows. Isolated skeletal muscles did not respond to stimulations affecting the calcium exchanges in brain tissue. Author

N78-22613# Texas Univ. Health Science Center, Dallas. Dept. of Physiology.

VESTIBULO-COCHLEAR SINGLE UNIT RESPONSES TO MICROWAVE RADIATION c52

Robert M. Lebovitz and Ronald L. Seaman *In* Bur. Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 314-333 refs (For availability see N78-22591 13-51)

Avail. NTIS MF A01; SOD HC

The influence of microwave radiation (MWR) on functional neuronal properties was examined, and the effects of continuous wave MWR on units of the vestibular system were studied. The threshold for this effect appeared to be above the current standards for safe exposure; above a level for significant intracranial thermogenesis. The response of single auditory units to pulse modulated MWR were studied. Pulse parameters rather than average power density appeared to be the independent variable for this effect and responses were observed at pulse energy densities of 4 mvon J/g and lower. Overall, the response of a given single auditory unit to pulsed MWR was similar to its response to traditional acoustic click stimuli. Author

N78-22614# National Academy of Sciences - National Research Council, Washington, D. C. Medical Follow-up Agency.

CAUSES OF DEATH FOLLOWING OCCUPATIONAL EXPOSURE TO MICROWAVE RADIATION (RADAR) 1950 - 1974 **c52**

C. Dennis Robinette and Charlotte Silverman (Bur. of Radiol. Health, Rockville, Md.) *In* Bur. Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 338-344 refs (For availability see N78-22591 13-51)

Avail: NTIS MF A01; SOD HC

The effects of microwave radiation on the health of naval personnel was assessed, by taking advantage of marked occupational differences in level of exposure, and the availability of the extensive medical information recorded during service and subsequently in the veteran period of the Korean war. Extant records utilizing mortality and morbidity, and reproductive performance were utilized. Author

N78-22615# Armed Forces Inst. of Pathology, Washington, D. C. Ophthalmic Pathology Div.

EFFECTS OF REPEATED MICROWAVE IRRADIATIONS TO THE ALBINO RABBIT EYE

S. E. Hirsch (Walter Reed Gen. Hosp.), B. Appleton (Walter Reed Gen. Hosp.), B. S. Fine (Walter Reed Army Inst. of Res.), and P. V. K. Brown *In* Bur. Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 345-350 refs (For availability see N78-22591 13-51) (Grant FD-00686)

Avail: NTIS MF A01; SOD HC

Exposure of 3000 MHz were administered to the left eye of each animal for a 15 minute period. Clinical examination, including light and electron microscopy, was carried out during the year. Below 300 mW/sq cm no occular changes were detected. At 300 mW sq cm and above, all eyes reacted with congestion of the limbal vessels, pupillary constriction, and evidence of iritis. M.V.

N78-22616# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.

ARE MICROWAVE CATARACTS THERMALLY CAUSED? **c52**

R. L. Carpenter, G. J. Hagan, and G. L. Donovan *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 352-379 refs Sponsored in part by Naval Med. Res. and Develop. Command (For availability see N78-22591 13-51)

Avail: NTIS MF A01; SOD HC

In the rabbit eye, 2.45 GHz radiation caused an immediate increase in intraocular temperature and, after a latent period of a few days, development of opacities in the posterior subcapsular cortex of the lens. External application of heat to the eye induced the same increase in intraocular temperature over the same duration of time as did a cataractogenic microwave exposure. It was concluded that an increase in intraocular temperature occurring during microwave irradiation was not the sole causative factor in microwave cataractogenesis. Author

N78-22617# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.

HEAT-INVOKED CHANGES IN ASCORBIC ACID LEVELS ON THE RABBIT EYE

Esther S. Ferri *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 380-386 refs Sponsored in part by Naval Res. and Develop. Command (For availability see N78-22591 13-51)

Avail: NTIS MF A01; SOD HC

Levels of ascorbic acid were determined in the microwave irradiated eye of the rabbit. Results did not agree with an investigation previously reported using the same exposure and analyses conditions. A possible explanation of the cause of these discrepancies was attempted. Heat alone was ruled out as the causative factor involved in alterations of ascorbate in the microwave irradiation of the eye. Author

N78-22618*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE USE OF AN ION-BEAM SOURCE TO ALTER THE SURFACE MORPHOLOGY OF BIOLOGICAL IMPLANT MATERIALS

A. J. Weigand 1978 28 p refs Presented at Soc. for Biomater. Conf., San Antonio, 29 Apr. - 2 May 1978 (NASA-TM-78851; E-9573) Avail: NTIS HC A03/MF A01 CSCL 06C

An electron bombardment, ion thruster was used as a neutralized-ion beam sputtering source to texture the surfaces of biological implant materials. Scanning electron microscopy was used to determine surface morphology changes of all materials after ion-texturing. Electron spectroscopy for chemical analysis was used to determine the effects of ion texturing on the surface chemical composition of some polymers. Liquid contact angle data were obtained for ion textured and untextured polymer samples. Results of tensile and fatigue tests of ion-textured metal alloys are presented. Preliminary data of tissue response to ion textured surfaces of some metals, polytetrafluoroethylene, alumina, and segmented polyurethane were obtained. Author

N78-22619# European Space Agency, Paris (France).

LIFE-SCIENCES RESEARCH IN SPACE

W. R. Burke, ed. and T. D. Guyenne, ed. Sep. 1977 374 p refs Proc. of a Symp. held at Cologne, 24-26 May 1977; co-sponsored by DFVLR, CNES, and Roy. Soc. (ESA-SP-130) Avail: NTIS HC A16/MF A01

Selected papers on life-science experiments for NASA-ESA spacelab flight, cardio-pulmonary and vascular problems, fluid metabolism, sensorial functions, plant physiology, radiobiology, and biomechanics are presented. For individual titles, see N78-22620 through N78-22667.

N78-22620* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SUMMARY OF PAST FINDINGS IN BIOMEDICAL RESEARCH ACCUMULATED DURING APOLLO AND SKYLAB MISSIONS **c52**

R. S. Johnston and L. F. Dietlein *In* ESA Life-Sci. Res. in Space Sep. 1977 p 7-27 refs (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01 CSCL 06B

The specific equipment used in carrying out the experiments (including an evaluation of the cardiovascular system, a study of metabolic activity, investigations in the field of neurophysiology, the determination of changes in body fluids, measurement of total body metabolism, and a study of crew performance through a time and motion experiment) is outlined. The frequency and the test protocols are reviewed and the significant observations and data obtained are presented. In addition, the techniques used to monitor crew health to assist in making real-time mission decisions are discussed. ESA

N78-22621* National Aeronautics and Space Administration, Washington, D. C.

NASA - SELECTED LIFE SCIENCE EXPERIMENTS FOR THE FIRST NASA/ESA SPACELAB FLIGHT 1980

Carl A. Larson *In* ESA Life-Sci. Res. in Space Sep. 1977 p 29-34 (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01 CSCL 06B

Spacelab 1 will carry 17 NASA-sponsored research projects. Seven of these investigations will concern the life sciences. Because of NASA's interest in space motion sickness, two vestibular studies will be conducted. Two other experiments will be concerned with the effects of spaceflight on the hematologic system. The fifth life science study will involve nutations in plant organs. The sixth investigation will examine the effects of the Spacelab environment on circadian rhythms in microorganisms.

Finally, cosmic radiation inside the Spacelab will be mapped. These seven life science experiments represent both basic and applied areas of research. Author (ESA)

N78-22622 European Space Agency, Paris (France).
LIFE SCIENCES SELECTED EXPERIMENTS FOR THE FIRST JOINT NASA/ESA SPACELAB MISSION
H. Oser *In its* Life-Sci. Res. in Space Sep. 1977 p 35 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The life-sciences selected experiments on human physiology and radiation biology for the first joint NASA-ESA Spacelab mission are briefly summarized. ESA

N78-22623 European Space Agency, Paris (France).
GENERAL LIFE SCIENCE FACILITIES FOR SPACELAB MISSIONS UNDER DESIGN IN EUROPE c12
G. Seibert *In its* Life-Sci. Res. in Space Sep. 1977 p 37-43 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The technical characteristics and capabilities of some experimental facilities for life sciences investigations on board Spacelab are summarized. In 1976, ESA charged the company ERNO with the performance of a conceptual design study of a facility called space sled with which vestibular investigations are possible. The technical concept of sled consists of a plastic rail-guided seat shell in which a human subject (crew member) or an animal can be accelerated and decelerated along a straight line between one end of the Spacelab module and the other. Sled can also be oscillated along the longitudinal axis of Spacelab. The mechanical drive will be provided by an electric motor. Based on a requirements review of proposed life sciences experiments for Spacelab, ESA charged the companies Dornier System and STEEL with a design and cost study of four incubator/holding units for cells and tissues, plants, amphibia, and fish.
Author (ESA)

N78-22624 Rome Univ. (Italy). School of Aerospace Medicine.
THREE-DIMENSIONAL BALLISTOCARDIOGRAPHY IN WEIGHTLESSNESS c52
Aristide Scano *In* ESA Life-Sci. Res. in Space Sep. 1977 p 51-57 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Essential information is given on the simple and non-invasive method of exploring cardiovascular functions and on the principal characteristics of the recording that can be obtained of body motions and accelerations due to cardiac activity and to the movement of blood in the large vessels. Mention is made of some uncertain and not yet clarified aspects of the phenomenon and of the reasons for the proposal to carry out research on it in the Spacelab. Finally a description is given of the purposes of this investigation, of the experimental method to be used on the ground and in flight, and of the tests in progress to improve its reliability and simplicity. Author (ESA)

N78-22625 Centre de Recherches de Medecine Aeronautique, Paris (France). Ecole d'Application.
ELECTRICAL IMPEDANCE AND MECHANOGRAPHY, METHODS OF CARDIO-VASCULAR INVESTIGATION IN SPACE c52
J. Colin and R. Carre *In* ESA Life-Sci. Res. in Space Sep. 1977 p 59-67 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Two non-invasive techniques can be used in space to study cardiac functions. These techniques consist in synchronous recording of the electrocardiogram, phonocardiogram and carotidogram, and (or) electrical impedance plethysmogram. The material and methods allow, with these techniques, measurement of systolic time intervals and evaluation of stroke volume and cardiac output. Compared results obtained are presented and discussed. They demonstrate the feasibility of using these techniques to estimate the transient changes in cardiovascular function during space flight. Author (ESA)

N78-22626 Centre Hospitalier Universitaire Rangueil, Toulouse (France). Dept. of Neurology.
CEREBRAL CIRCULATION IN WEIGHTLESSNESS: COMPARISON AND VALIDATION OF DIFFERENT METHODS c52
A. Bes, L. Braak, A. Guell, P. Jauzac, G. Geraud, and A. Blasco *In* ESA Life-Sci. Res. in Space Sep. 1977 p 69-73 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Some methods of cerebral blood flow measurement, with emphasis on the non-invasive methods are reviewed. The difficulties arising from the use of rheoencelography are pointed out. ESA

N78-22627 Freie Univ., Berlin (West Germany). Inst. fuer Physiologie.
THE MEASUREMENT OF TISSUE THICKNESS AND TISSUE COMPLIANCE IN MAN c52
K. Kirsch, M. Barnkow, and W. Hepp (Dornier System G.m.b.H.) *In* ESA Life-Sci. Res. in Space Sep. 1977 p 75-79 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

In order to determine tissue thickness above an underlaying bone, an ultrasonic device was used. With the help of a surrounding plexiglas chamber subatmospheric or hyperbaric pressures between -15 to +15 mmHg could be applied to the tissues. An attempt was made to calculate the compliance of the tissue structures. The values derived were in the range of from 3 to 6.5 ml/kg tissue/1 mmHg. Author (ESA)

N78-22628 Freie Univ., Berlin (West Germany). Inst. fuer Physiologie.
CARDIO-RESPIRATORY ADAPTATION AND CENTRAL BLOOD VOLUME DURING WEIGHTLESSNESS c52
G. Koch *In* ESA Life-Sci. Res. in Space Sep. 1977 p 81-85 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

A brief review is given of the salient features of cardio-respiratory adaptation to exposure to 0-g conditions and to simulated weightlessness under whole body immersion. All physiological observations made hitherto in association with manned space flight are consistent with the concept that the weightlessness induced shift of blood volume from the lower body capacitance system to the central circulation acts as the trigger mechanism eliciting major changes in central hemodynamics, plasma volume, and renal function. Excellent studies performed during simulated weightlessness (immersion) are now available which quantitatively define the majority of changes occurring under these circumstances within the cardiovascular, respiratory, and renal systems. It appears imperative that advantage should be taken of future space flight programs to analyze quantitatively these changes during true in-flight weightlessness conditions as well. Concerning the cardio-respiratory system the key data desired are ventricular filling pressures and cardiac output.
Author (ESA)

N78-22629 Deutsche Sporthochschule, Cologne (West Germany). Inst. fuer Physiologie.
CIRCULATORY, RENAL AND ENDOCRINE REACTIONS ON SIMULATED WEIGHTLESSNESS DEPENDENT ON PHYSICAL FITNESS STATE c52
J. Stegemann and W. Skipka *In* ESA Life-Sci. Res. in Space Sep. 1977 p 87-92 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Effects of head-out immersion on circulatory, renal, and endocrine reactions were estimated in endurance-trained athletes (TR) and untrained subjects (UT). Heart rate was increased in all subjects while blood pressure decreased. The reduced diuresis and natriuresis of the TR were caused by a smaller ADH inhibition, a smaller and delayed increase of GFR and a smaller diminution of aldosterone secretion. VMA excretion increased only in the UT, whereas plasma renin activity was attenuated in both groups. Furthermore the gain of blood pressure control was generally reduced in TR which leads to the more reduced orthostatic tolerance of this group. Intermittent exercise during immersion had a protective effect of orthostatic stability in all subjects.ESA

N78-22630 Clinical Research Centre, London (England).
PERSONAL INSTRUMENTATION FOR THE REGISTRATION OF CARDIOVASCULAR AND ELECTROPHYSIOLOGICAL

SIGNALS c52
H. S. Wolff *In* ESA Life-Sci. Res. in Space Sep. 1977 p 93 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Means available which allow continuous recording of both environmental and physiological signals using light equipment without imposing significant restrictions on activity are presented. Problems encountered in ambulatory monitoring are briefly outlined. ESA

N78-22631 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
POSSIBLE MECHANISMS OF MOTION AND SPACE SICKNESS c52
A. J. Benson *In* ESA Life-Sci. Res. in Space Sep. 1977 p 101-108 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The malaise induced by head movements on initial exposure to weightlessness is similar in symptomatology and natural history to that induced by provocative motion on earth. It is argued that space sickness, like other forms of motion sickness, occurs because of a disruption of established associations in the pattern of sensory information from vestibular receptors. The sensory mismatch, caused by the abnormal stimulation of the otoliths in weightlessness, is identified, and the nature of the sensory rearrangement, that is an essential feature of adaptation to the atypical force environment, is examined. Author (ESA)

N78-22632 Neurologische Universitaetsklinik, Freiburg im Breisgau (West Germany). Abt. fuer Neurophysiologie.
OPTICALLY INDUCED SELF-MOTION PERCEPTION c52
Johannes Dichgans *In* ESA Life-Sci. Res. in Space Sep. 1977 p 109-112 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Large moving visual fields elicit the sensation of ego-motion via convergence of visual inputs into the vestibular system. Through vision, the vestibular nuclei are supplied with constant velocity information. Motion stimuli in an earth vertical plane elicit the perception of continuous motion but limited displacement. Visuo-vestibular convergence subserves dynamic spatial orientation and postural stabilization. Author (ESA)

N78-22633 Neurologische Klinik der Krupp Krankenanstalten, Essen (West Germany).
EXPERIMENTAL VERTIGO, ATAXIA AND MOTION SICKNESS: VISUAL-VESTIBULAR INTERACTION ON EARTH AND IN SPACE c52
Thomas Brandt *In* ESA Life-Sci. Res. in Space Sep. 1977 p 113-115 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Vertigo and optokinetic motion sickness can be elicited by pure angular oscillation of the visual around about a vertical axis or by summation of visual pseudo coriolis or Purkinje effects. Experiments on earth revealed a direction-specific optokinetic modulation of vestibular disorientation and nausea resulting in either inhibition or facilitation. It can be expected that weightlessness in space magnifies the relative importance of visual cues within the multisensory processes of dynamic spatial orientation. Author (ESA)

N78-22634 Centre National de la Recherche Scientifique, Paris (France). Lab. de Physiologie du Travail.
VISUAL-VESTIBULAR INTERACTION DURING LINEAR MOTION c52
A. Berthoz, A. Buizza (Pavia Univ.), and R. Schmid (Pavia Univ.) *In* ESA Life-Sci. Res. in Space Sep. 1978 p 117-125 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The studies of visual vestibular interaction in the case of linear motion which were made in the last few years by several groups are reviewed. They concern (1) the measurement of the psychophysical parameters of self-motion perception induced by visual scenes moving linearly (Linear Vection), (2) the fact that linear acceleration modifies the perceived velocity of a visual scene, (3) the postural readjustments induced by moving visual scenes on standing subjects and the effects of spatial frequency, and (4) the contribution of vision during postural perturbation during linear accelerations. The problem of the effect of linear acceleration on fusion during vergence and the possible contribution of the otolithic system to the improvement of the dynamics of fusional vergence was examined. Suggestive evidence is given that linear acceleration does improve the dynamics of fusion. Author (ESA)

N78-22635 Swedish Air Force, Stockholm.
VESTIBULAR TESTS DURING SPACE FLIGHT c52
Ulf Brandt *In* ESA Life-Sci. Res. in Space Sep. 1977 p 127-129 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

In past space missions the assessment of vestibular function on operational and experimental conditions was mainly based upon subjective information. The findings have therefore been hard to insert in their correct physiological context. With Spacelab the medical supervision and the biomedical effort enter a new phase according to the facilities of in-flight electronystagmography. This will offer possibilities of re-evaluating a biological system which is conditioned by gravity. A description is given of a centrifuge method, which gives the opportunity of testing and recording objectively caloric reaction under varying g loads. The applicability of this provoked vestibular test during future space research is considered. Author (ESA)

N78-22636 Pittsburgh Univ., Pa.
THE EFFECT OF GRAVITY ON THE STATIC AND DYNAMIC PROPERTIES OF SINGLE VESTIBULAR UNITS INVESTIGATED IN THE BULL FROG BY MEANS OF A VESTIBULAR ORBITAL LABORATORY (VOL). NASA Shuttle Spacelab Vestibular Function Research Program (VFR)
Torquato Gualtierotti, Principal Investigator *In* ESA Life-Sci. Res. in Space Sep. 1977 p 131-138 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The NASA Vestibular Function (VFR) Program further investigates the behavior of the same simple vestibular units, comparatively, in free fall and at different g levels, earth gravity included. It is a study of basic vestibular physiology and an attempt to understand the mechanism of the space sickness. A follow-up of the OFO-A vestibular space experiment, which provided the first information on the effect of free fall on single vestibular units in the bull frog, the VFR program will test hypnotised mechanisms of the observed vestibular reversible or irreversible functional alterations. To this end a Vestibular Orbital Laboratory (VOL) will be flown in several shuttle Spacelab missions. The VOL is capable of fully supporting four bull frogs for up to 60 days, monitoring single vestibular units activity applying various stimulations to study the static and dynamic properties of efferents and efferents in weightlessness and during artificial gravities. Author (ESA)

N78-22637 Glasgow Univ. (Scotland). Inst. of Physiology.
THE RELATIONSHIP OF GRAVITY TO VESTIBULAR STUDIES c52
T. D. M. Roberts *In* ESA Life-Sci. Res. in Space Sep. 1977 p 139-145 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

In the postural adjustments necessary for balance the vestibular system has hitherto been thought of as providing a reference indication of the upright direction. However, the reactions to overbalancing turn out to depend on recognition that the resultant of the supporting upthrusts is approaching the edge of the available area of support. In the absence of sufficient cues the subject falls over. The otolith organs resemble accelerometers and must accordingly respond to stress gradient. This means that they will indicate the current direction of support thrust, even in a moving vehicle, rather than some reference direction such as that of gravity. Author (ESA)

N78-22638 Karolinska Institutet, Stockholm (Sweden). Ent Dept.
THE MAMMALIAN OTOCYST IN VITRO. A MODEL SYSTEM FOR EXPERIMENTAL PATHOLOGY ON EARTH AND IN SPACE c52
P.-G. Lundquist, T. R. VanDeWater, J. Wersaell, and M. Anniko *In* ESA Life-Sci. Res. in Space Sep. 1977 p 147-153 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Labyrinthine receptor pathology is discussed with respect to toxic agents affecting the sensory cells directly or the secretory epithelia that is necessary for normal labyrinthine metabolism. Developmental hereditary malformations are discussed. The mammalian otocyst is presented as a model system for research in labyrinthine pathology. Studies are described which incorporate morphogenesis as well as the development of sensory structures in vitro. An outline of the experiment with the mammalian otocyst developing in a space travel environment is described and the possible effects of this environment upon labyrinthine receptors are discussed. Author (ESA)

N78-22639 Rouen Univ. (France). Lab. Neurophysiologie Sensorielle.

INFLUENCE OF GRAVITY AND WEIGHTLESSNESS ON MATURATION OF THE EQUILIBRIUM FUNCTION c52

A. Gribenski *In* ESA Life-Sci. Res. in Space Sep. 1977 p 155-162 refs (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01

In fish and in frog tadpoles it seems that weightlessness during development influences neither structure nor function of equilibrium organs. Experiments are being planned in order to know whether in the rat weightlessness (or hypergravity) has an influence on the maturation of equilibrium function. The equilibrium of young rats whose fetal and/or early postnatal development will have taken place in weightlessness (or in hypergravity) will be compared with that of young rats whose development will have taken place in normal conditions of gravity. Up to now the maturation of equilibration in the rat has been studied considering three types of reactions: air-righting, rotatory reactions, and dynamic equilibration on a horizontal mast rotating around its axis. Author (ESA)

N78-22640 Paris Univ. (France). Faculty of Medecine Lariboisiere-St. Louis.

RESPONSES OF THE FROG TO ANGULAR ACCELERATIONS IN WEIGHTLESSNESS

M. Burgeat, D. Loth, C. Menguy, M. Toupet (Rouen Univ.), and A. Gribenski *In* ESA Life-Sci. Res. in Space Sep. 1977 p 163 (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01

It has been proposed to verify in an experiment how a change in the controlling effect of the otolith organs in frogs, caused by change of weightlessness, could modify the vestibular responses to angular accelerations during orbital flights. ESA

N78-22641 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

DEVELOPMENT OF THE VESTIBULUM OF FROG EMBRYOS AND LARVAE ON THE FAST RUNNING CLINOSTAT

J. Neubert and W. Briegleb *In* ESA Life-Sci. Res. in Space Sep. 1977 p 165-168 refs (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01

Some experiments were exposed to study the influence of simulated weightlessness on the development of the vestibular organ of frog embryos and larvae which grew up from fertilization of the eggs on a fast running horizontal clinostat. No abnormalities could be detected in the morphological structure with light and electron-microscopic methods. The results are discussed together with those of comparable flown experiments (Soyus 10, Salyut 4; Biosatellite 2, Gemini 8 and 12) and good accordance was found. Furthermore, some observations of behavior patterns of the animals are discussed. Author (ESA)

N78-22642 Centre de Recherches de Medecine Aeronautique, Paris (France). Ecole d'Application.

VISION AND SPACEFLIGHTS c52

G. Perdriel *In* ESA Life-Sci. Res. in Space Sep. 1977 p 169-171 (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01

Since the first space flights, a more complete knowledge of the visual phenomena experienced by the astronauts, especially after the observations made in spacecraft has been acquired. The visual functions can be altered during the various phases of space navigation. During take-off, the deleterious effects of accelerations were prevented by placing the astronauts in a supine position. During long-term flight, at 0 gravity, visual acuity is improved but chromatic perception decreases. Abnormal visual perceptions (light flash phenomena) can also appear. Lunar approach and stay on the moon require adaptation of visual functions. Author (ESA)

N78-22643 Rome Univ. (Italy). Eye Clinic.

THE CRITICAL CENTRAL RETINAL FUSION FREQUENCY (CCRFF) AS A TEST OF THE RETINAL CIRCULATORY FUNCTION AND ITS RELATION WITH ENCEPHALIC CIRCULATION c52

Giacomo C. Modugno *In* ESA Life-Sci. Res. in Space Sep. 1977 p 173-175 (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01

The Critical Central Retinal Fusion Frequency (CCRFF) representing the power of fusing intermittent light stimuli is discussed in terms of physical factory effects, operational fatigue tests, and nonverbal mental attitude tests. The instrument developed for the quick measurement of CCRFF is briefly described. Investigations conducted at the Italian Air Force Aviation, at the Sports Medicine Institute of the Italian National Olympic Committee, at Rome University Oculistic Clinic are presented. ESA

N78-22644 Clermont-Ferrand Univ. (France). Lab. de Biophysique.

EFFECTS OF X-RAYS ON THE RAT RETINA AND ON RHODOPSIN

M. Doly, D. B. Isabelle, A. Tetefort, G. Gaillard, and G. Meyniel *In* ESA Life-Sci. Res. In Space Sep. 1977 p 177-181 refs (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01

In order to explain the mechanism of phosphene induction during the space flight a study of the X-ray action on isolated retina and on separated rhodopsin was undertaken. An experimental set-up was developed to maintain albino rats' retina in a survival state and to record the electroretinogram (ERG) response for various types of stimulation. It was found that the ERG signal as well as the survival curve are similar for X-ray and light stimulations. A relative efficiency of X-ray vs. light was determined. To confirm the hypothesis of an X-ray direct action on the photoreceptors, the modifications of the rhodopsin absorption spectrum induced by X-ray irradiation were measured. It was found that the rhodopsin molecule is broken down by X-ray. Author (ESA)

N78-22645 Nijmegen Univ. (Netherlands). Dept. of Biochemistry.

EFFECTS OF HARD RADIATION ON THE VISUAL PIGMENT RHODOPSIN c52

S. L. Bonting, P. A. A. Jansen, and F. J. M. Daemen *In* ESA Life-Sci. Res. in Space Sep. 1977 p 185-189 refs Sponsored by Roy. Neth. Acad. of Sci. (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01

Light flashes, seen by astronauts in the absence of visible light during translunar flights, are thought to be due to interactions of cosmic rays with the visual system. As part of a program for the assessment of the nature and reversibility of this interaction, the visual pigment rhodopsin has been exposed to proton and electron irradiation. From determinations of various parameters it is concluded that this type of radiation at certain dosage levels can cause an irreversible breakdown of rhodopsin. The number of rhodopsin molecules damaged per incident proton varies from 1500 to 176,000 over the dose range, suggesting that passage of a single high energy particle through the retina could in principle excite a sufficient number of photoreceptor cells to cause observation of a light flash. Author (ESA)

N78-22646 University Coll., Cardiff (Wales). Botany Dept.

CIRCUMNUTATION AND GRAVITY

David G. Heathcote *In* ESA Life-Sci. Res. in Space Sep. 1977 p 195-201 refs Sponsored in part by Roy. Soc. (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01

A review of theoretical models of the mechanism underlying the rhythmic plant movement, circumnutation is presented. Evidence in support of the most widely accepted theory, proposed

by Israelsson and Johnsson, which describes the movement in terms of a feedback oscillation of the geotropic attitude control system of the plant is briefly described, together with some new data that seem to conflict with the predictions of the model. It is suggested that final resolution of the problem requires experimental work in a mu-g environment. The rationale and objectives of a series of proposed Spacelab flight experiments on this subject are discussed. Author (ESA)

N78-22647 Oxford Univ. (England). Botany School.
TESTING THE MECHANISM OF GRAVITY SENSING IN PLANTS
B. E. Juniper *In* ESA Life-Sci. Res. In Space Sep. 1977 p 203-212 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The statolith theory of graviperception in plants has existed with fluctuating fortunes for over seventy-five years. The simple system in Chara is well authenticated but probably cannot be translated to the higher plant. A lot now is known about the fine structure, number and distribution of the cells that perceive gravity in the higher plant. But a common system for both shoot and root now seems unlikely, since both hormonal and transport systems appear to differ. In spite of considerable research no satisfactory system has been put forward and suggestions are made for testing the still speculative models of this rapid and flexible system. Author (ESA)

N78-22648 Bonn Univ. (West Germany). Inst. of Botany.
ULTRASTRUCTURAL ASPECTS OF GRAVITY-PERCEIVING CELLS IN CRESS ROOTS
D. Volkmann and A. Sievers *In* ESA Life-Sci. Res. in Space Sep. 1977 p 213-216 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The gravity-perceiving cells (statocytes) of roots are polarly organized. They are characterized by sedimentable particles (amyloplasts) and a striking endomembrane system (ER complex). During the normal downward oriented growth of the root, the amyloplasts are sedimented on the ER complex. Some observations indicate that the amyloplasts stress the ER membranes by their sedimentation. The membranes of the ER complex fulfill the preconditions of a gravisensor. For a short time the amyloplasts can be separated from the ER complex under different experimental conditions. This is important for further information on graviperception. However, a long-term separation with consecutive experiments is possible only under 'total weightlessness' in space. Experiments for the Spacelab program are suggested.
Author (ESA)

N78-22649 Paris VI Univ. (France). Lab. de Cytologie et Morphogenese Vegetales.
GEOPERCEPTION IN LENTIL ROOTS
G. Perbal *In* ESA Life-Sci. Res. in Space Sep. 1977 p 217-222 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The mode of action of the statoliths is analyzed on lentil roots. It is shown that the geotropic response of roots is due to the displacement of the statoliths, their pressure and their contacts on a sensitive surface located along the distal wall of the statocytes. The nature and the position of this sensitive surface was also investigated. It is demonstrated that it could be the tubules of endoplasmic reticulum lining the plasmalemma, if a physical contact must occur between the sensitive surface and the amyloplasts. If such a contact is not needed it could also be represented by the microtubules or the plasmalemma. The preinversion effect is discussed in the light of these results. It is concluded that a space experiment should be done on the effects of low centrifugal accelerations on the development of roots.
Author (ESA)

N78-22650 Lausanne Univ. (Switzerland). Inst. of Plant Biology and Physiology.
ROOT GEOREACTION: GRAVITY EFFECT ON HORMONE BALANCE
P. E. Pilet *In* ESA Life-Sci. Res. in Space Sep. 1977 p 223-227 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The root cap produced growth inhibiting regulators which control the root georeaction and the growth of root. These inhibitors (and abscisic acid is one of them) were transported basipetally and laterally (downward movement inside the apex of horizontal roots). The lower part of the root cap, from a geo-stimulated root, produced inhibitors in larger amount as compared with the upper part. Consequently, the level of these inhibitors was greater in the lower extending zone of the root which presents a positive georeaction. Author (ESA)

N78-22651 Agricultural Research Council, Cambridge (England). Unit of Development Botany.
CONTROL OF CELL GROWTH AND HORMONE LEVELS BY GRAVITY
M. Wright and Daphne J. Osborne *In* ESA Life-Sci. Res. in Space Sep. 1977 p 229-233 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Flowering shoots of the grass Echinochloa colonum provide excellent material for studying the control of cell growth by gravity. Their georesponsive cells normally elongate only in response to a gravitational stimulus. These cells, located in the leaf sheath base (the nodes) elongate on the lower side but not on the upper side when shoots are placed horizontally. Elongation can be related to auxin content; within 30 mins of placing horizontal auxin levels increase on the lower side and decrease on the upper side of excised half nodes. Models are proposed in which changes in auxin levels and corresponding cell elongation are attributed to a growth promoting signal transmitted from the statocyte cells. Experiments, designed for the zero gravity conditions of Spacelab, could (1) indicate possible relationships between ultrastructure and geosensitivity and (2) give information on the mechanism of action of the statoliths. Author (ESA)

N78-22652 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
STANDARD EQUIPMENT FOR PHYSIOLOGICAL EXPERIMENTS IN WEIGHTLESSNESS **c12**
G Brandau, J. C. Dietrich, B. Hofer, H. U. Knoop, H. Schaus (W.C. Heraeus GmbH), H. Schienle (W.C. Heraeus GmbH), H. Sinn (Heraeus-Christ GmbH), and E. Roedel (Heraeus-Christ GmbH) *In* ESA Life-Sci. Res. in Space Sep. 1977 p 235-244 ref (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The design of standard equipment for physiological experiments in the area of geomorphosis and geotropism for multiple use in Spacelab is described. The equipment essentially consists of four types of a modular, airconditioned chamber for plants up to 30 cm height, a small reference centrifuge for gravity simulation, an automatic exchange mechanism for agar plates, a photographic system, and the necessary control and data management system for semiautomatic operation of the equipment. The equipment is planned to fly first in 1981.
Author (ESA)

N78-22653 Kiel Univ. (West Germany). Inst. fuer Reine und Angewandte Kernphysik.
THE COSMIC RAY SITUATION IN THE ORBIT OF SPACELAB **c93**
O. C. Allkofer *In* ESA Life-Sci. Res. in Space Sep. 1977 p 251-256 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

In the orbits of Spacelab the primary cosmic ray flux will bombard the space vehicle, unshielded by the atmosphere. The radiation fluxes of all components should be known because firstly the effects onto biological objects will be studied and because secondly the radiation hazard for the men working in the Spacelab must be evaluated. The radiation hazard due to the galactic protons and heavy nuclei and due to the solar flare events will be evaluated. Also the influence due to the south Atlantic magnetic anomaly is considered. Author (ESA)

N78-22654 Zurich Univ. (Switzerland). Radiobiological Inst.
RADIOBIOLOGICAL EFFECTS AT LOW DOSES. THE ROLE OF SPATIAL AND TEMPORAL ENERGY DISTRIBUTION **c52**
Hedi Fritz-Niggli *In* ESA Life-Sci. Res. in Space Sep. 1977 p 257-262 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The complexity of the radiobiological chain of events leads to the conclusion that, particularly for the low mean doses, the pattern of microscopic energy distribution is extremely important. In the inhomogeneous cosmic radiation the high LET components can produce effects by even low mean doses. Our investigations on the Relative Biological Effectiveness (RBE) values of negative pions in the peak (star) region show that intrinsic properties of the reaction system (e.g. radiosensitivity due by O2-tension) and the mode of realization determine the damage. Hypoxic systems with heteromultiple realization mechanisms (like embryonic damage, tumor induction) are the most suitable objects for space radiation biology. Author (ESA)

N78-22655 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

RESULTS OF RADIOBIOLOGICAL SPACEFLIGHT EXPERIMENTS **c52**

Horst Buecker *In* ESA Life-Sci. Res. in Space Sep. 1977 p 263-270 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Research in space radiobiology mainly deals with: (1) combined effects of cosmic radiation and other extreme factors of spaceflight. From the Biosatellite 2 experiments it was followed, that weightlessness was the main factor of spaceflight influencing the radiation response of biological matter; (2) biological response to high atomic number Z and high Energy (HZE) particles of cosmic radiation. The last Apollo missions accommodated several experiments on this matter, ALFMED, Biocore, and Biostack, which determined serious biological damage being produced by the passage of a single high atomic number Z and high energy (HZE) particle. The lateral distribution of biological effects around the trajectory of an high atomic number Z and high energy (HZE) particle was experimentally determined by means of high precision localization methods of the path of individual HZE-particles in relation to single biological cells; (3) radiation dosimetry during spaceflight, and (4) radiation protection guidelines for astronauts. Author (ESA)

N78-22656 Wuerzburg Univ. (West Germany). Inst. fuer Medizinische Strahlenkunde.

MICRODOSIMETRIC CONCEPTS RELEVANT TO HZE-PARTICLES **c72**

A. M. Kellerer *In* ESA Life-Sci. Res. in Space Sep. 1977 p 271-277 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The biological effectiveness of HZE-particles is determined by the extreme microscopic concentrations of energy transfer in the vicinity of the particle tracks. The concept of linear energy transfer fails to describe this situation adequately. The more rigorous microdosimetric concepts are presented. A simplified treatment, based on the radial distribution of energy around the track core, is then considered. Author (ESA)

N78-22657 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

RADIOBIOLOGICAL PROBLEMS OF EXOBIOLOGY

Gerda Horneck *In* ESA Life-Sci. Res. in Space Sep. 1977 p 279-284 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The main problems of exobiology are: (1) origin of life on earth or on any other place in the universe; (2) search for extraterrestrial forms of life; (3) interplanetary transfer of biological matter. In all of these topics the external influx of energy plays an important role. Sunlight, primarily in the ultraviolet (UV) region of the spectrum, was a powerful promoting factor in chemical and biological evolution, and it represents a strong sterilizing agent in space. Terrestrial microorganisms, directly exposed to space hard environment, were supersensitive to solar UV radiation. This is due to the production of non-repairable photoproducts. Terrestrial life is the only example of life we know until now. As long as the origin of life on earth was considered a kind of rare 'happy accident', there was little stimulus to search for extraterrestrial forms of life. However, there is every reason now to consider origin of life as a regular phenomenon during evolution of planets. Therefore, the events which led to the appearance of life on earth, may serve as a model for broader judgements of existence of life on other bodies of the universe. Author (ESA)

N78-22658 Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Inst. fuer Kernphysik.

METHODS OF MICRODOSIMETRY IN (SPACE) RADIATION BIOLOGY **c72**

E. Schopper and J. U. Schott (DFVLR, Cologne) *In* ESA Life-Sci. Res. in Space Sep. 1977 p 285-288 refs Sponsored by Min. of Res. and Technol. (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Improved methods for the study of the action of single ionizing particles on individual biological microstructures are presented, which are based on the known method of sandwiching the biological objects with solid state nuclear track detectors, and are using devices for the simultaneous handling and microscopic observation of the track detector and the object. A semi-automatic video-electronic scanning device is presented. The observation of biological microstructures of changing shape or changing position with respect to the passage of an ionizing particle, thus requiring the record of their instantaneous relative position, can be realized by the combination of a solid state track detector-sandwich plus bio-objects with a position-sensitive electronic particle detector: An example of the layout is presented. Together with the video-electronic scanning device it would also permit telemetric operation and data transmission. Author (ESA)

N78-22659 Toulouse Univ. (France). Lab. de Biologie Medicale.

GENERAL REMARKS AND TECHNIQUES FOR SPACE CELL BIOLOGY

H. Planel *In* ESA Life-Sci. Res. in Space Sep. 1977 p 295-298 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

General remarks are given on different objectives of space biology. Possible effects of weightlessness and cosmic rays are discussed. Furthermore, details are given on automatic fixation devices developed in the Toulouse laboratory and a correlative method used in order to study the individual effects of the cosmic heavy ions. Author (ESA)

N78-22660 Ghent Univ. (Belgium). Dept. of Anatomy.

EFFECTS OF SPACE ENVIRONMENT ON ORGANISM DEVELOPMENT

J. Fautrez *In* ESA Life-Sci. Res. in Space Sep. 1977 p 299-303 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Among various epigenetic factors conditioning the embryonic development, gravity was repeatedly shown to be of real importance, at least in vertebrates. It can intervene in normal development. It influences experimentally the organization of the germ. Experiments in weightlessness will show how gravity can influence the embryonic development. Author (ESA)

N78-22661 Messina Univ. (Italy). Dept. of General Physiology.

PHYSIOLOGICAL CHANGES IN SPACE TRAVEL AND THE CELLULAR MEMBRANE INVOLVEMENT

L. Bolis *In* ESA Life-Sci. Res. in Space Sep. 1977 p 305-309 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

After considering physiological problems encountered in space travel the importance of adaptive changes in living organisms is stressed. These changes are observed at organ level. The involvement of cellular membrane functional activities is described. Author (ESA)

N78-22662 Paris VI Univ. (France). Lab. de Pathologie Cellulaire.

EXPECTED EFFECTS OF WEIGHTLESSNESS ON CELL ULTRASTRUCTURE

M. Bouteille *In* ESA Life-Sci. Res. in Space Sep. 1977 p 311-313 refs Sponsored in part by Inst. Natl. de la Sante et de la Rech. Med., Delegation a la Rech. Sci., and Min. de la Qualite de la Vie (For availability see N78-22619 13-51)
(Grant CNRS-E.R.189)
Avail: NTIS HC A16/MF A01

Previous Skylab experiments have shown no drastic change in the ultrastructure of cultured embryonic cells in zero gravity environment. In fact conspicuous alterations of the cell structure are only observed after prolonged and specific action of eventually lethal agents. Further studies may be of interest. Most cells exhibit polarity. The special relationship of cell organelles with respect to each other might be significantly altered by weightlessness. The reconstitution of cell nuclei, after mitosis, could also be influenced. Finally, the rate of kinetics of deoxiribonucleic acid and ribonucleic acid syntheses and the location of their products of synthesis as studied by electron microscopic techniques of localization are expected to be modified.
Author (ESA)

N78-22663 Institut Pasteur, Paris (France).
MICROBIOLOGY AND SPACE
C. Hannoun *In* ESA Life-Sci. Res. in Space Sep. 1977 p 315 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Several aspects of microbiology, space technology and research are presented. The first approach deals with the conditions of the life of crew during manned flight; the second with the eventual effects of space environment and its main factors on host microorganisms to be brought back on earth at the end of the flight. Another aspect of research in space microbiology is related to the investigations on extraterrestrial iife or forms of life.
ESA

N78-22664 Brussels Univ. (Belgium). Interdisciplinary Bone Biomechanics Center.
THE APPLICATION OF IN-VIVO MEASUREMENTS OF BONE STRAIN TO SPACELAB PROGRAM. PRELIMINARY RESULTS **c52**
F. Burny, M. Hinsenkamp, R. Bourgois, V. Demolder, M. Donkerwolcke, and F. Moulart *In* ESA Life-Sci. Res. in Space Sep. 1977 p 321-326 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

It is of great interest to measure the incidence of weightlessness on the functional loading of the bones. Strain gages attached to the bone can record their deformation during various activities, for short periods of time. The objective of this study is to compare the mechanical response of a bone of an animal submitted normal gravitation and to weightlessness; long term measurements are therefore needed. A transducer made of a strain gage embedded in epoxy resin (the nucleus) was developed. The nucleus is sealed in a porous shell with epoxy adhesive. The fixation of the transducer will occur by bone ingrowth into the porous shell. Preliminary results are presented.
Author (ESA)

N78-22665 Max-Planck-Institut fuer Landarbeit und Landtechnik, Bad Kreuznach (West Germany).
HUMAN RESPONSE TO VIBRATION UNDER DIFFERENT CONDITIONS **c54**
H. Dupuis *In* ESA Life-Sci. Res. in Space Sep. 1977 p 327-333 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

Vibration stress is the vibration environment (of a physical nature) which externally effects the man. Vibration strain may be defined as the sum of all reactions of the human being to the vibration stress. This includes biomechanical behavior of particular parts of the body, physiological reactions of circulation, respiration, muscular system, nervous system, and systems of the senses, subjective intensity of vibration perception, decrease of performance, and injuries to health. Knowledge about these reactions is necessary to evaluate man's vibration stress and to improve technical transportation systems.
Author (ESA)

N78-22666 Centre de Recherches de Medecine Aeronautique, Paris (France). Lab. Central de Biologie Aeronautique.
DETERMINATION OF THE BIOMECHANICAL PARAMETERS OF MAN'S VERTEBROMUSCULAR AXIS **c52**
P. Quandieu, B. Cailler, L. Pellieux, and P. Borredon *In* ESA Life-Sci. Res. in Space Sep. 1977 p 335-341 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

A model of man's vertebro-muscular axis shaped as an equal beam stress, the marrow being the neutral line and the bony column exhibiting a buckling phenomenon is presented. This model obeys the law of visco-elasticity. Its deformation under the effect of applied forces or displacements can be calculated using the NASTRAN program (method of finite elements).
ESA

N78-22667 Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
HUMAN TOLERANCE OF REPEATED SHOCKS **c52**
G. R. Allen *In* ESA Life-Sci. Res. in Space Sep. 1977 p 343-349 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

The first tentative approach to a possible ISO specification covering repeated shocks is restated, and the reasoning and assumptions underlying this approach are explained. A recent elaboration by Peter Payne of the U.S. is outlined and discussed, including important problem areas which need to be resolved. New evidence from the U.K. is presented, and, together with that from Payne, is used to help prepare a further draft specification. A plea is made for the provision of more data and for critical, constructive consideration of the foundations of the approach.
Author (ESA)

N78-22668# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND AEROSPACE MEDICINE, VOL 11, NO. 6, 1977
14 Feb. 1978 142 p refs Transl. into ENGLISH of Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 139 p (JPRS-70633) Avail: NTIS HC A07/MF A01

Various studies are presented on biological problems encountered during space flight due to weightlessness and lack of exercise. Problems such as hypokinesia, hypothalamus, motion sickness, and blood disorders are examined. For individual titles, see N78-22669 through N78-22686.

N78-22669# Joint Publications Research Service, Arlington, Va.
CHANGES IN PERIPHERAL BLOOD OF CREW MEMBERS OF THE SALYUT-4 ORBITAL STATION **c52**
V. I. Legenkov, R. K. Kiselev, V. I. Gudim, and G. P. Moskaleva *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 1-12 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow) v. 11, no. 6, 1977 p 3-12 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

The hematological indices of crew members of the Salyut-4 orbital station and, for the sake of comparison, the same parameters of the crew of Salyut-3 after a 16-day mission are discussed.
Author

N78-22670# Joint Publications Research Service, Arlington, Va.
HUMAN ENDURANCE OF RECURRENT +G SUB z ACCELERATIONS **c52**
S. R. Kotovskaya, R. A. Vartbaronov, and M. N. Khomenko *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 13-21 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11 no. 6, 1977 p 12-19 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

Endurance of recurrent +Gz accelerations that are closer to piloting conditions was examined. It was necessary to study the following: (1) maximum tolerance of recurrent accelerations as related to acceleration gradient, as well as magnitude of maximum and minimum accelerations; (2) distinctions and dynamics of physiological reactions in the course of recurrent exposure to accelerations; and (3) effect of operator activity on endurance of recurrent accelerations.
Author

N78-22671# Joint Publications Research Service, Arlington, Va.
EFFECT OF PROLONGED WEIGHTLESSNESS ON METABOLISM OF PROTEINS IN RED AND WHITE SKELETAL MUSCLES OF RATS
V. A. Kazaryan, E. A. Rapoport, L. A. Goncharova, and S. Ya. Bulycheva *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 23-27 refs Transl.

into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11 no. 6, 1977 p 19-23 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

Biosynthesis of protein molecules was examined in different structural components of muscles of the fast and slow type in rats after they had made a 22-day flight on the Cosmos-605 biosatellite. The findings were compared to data obtained at comparable times on animals involved in a concurrent (synchronous) ground-based experiment, in a spacecraft cabin with the same life support systems. Author

N78-22672# Joint Publications Research Service, Arlington, Va.

FLUID-ELECTROLYTE METABOLISM IN ALBINO RATS AFTER A FLIGHT ON THE KOSMOS-690 BIOSATELLITE

N. A. Ilyushko, Ye. A. Ilin, Yu. I. Kondratyev, V. I. Korolkov, L. V. Kokoreva, and Yu. I. Khodkevich *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 28-31 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med., (Moscow), v. 11, no. 6, 1977 p 23-26 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

The fact that maintenance conditions, duration of flight and diet were identical on Cosmos-605 and Cosmos-690 made it possible to make a comparative analysis of the changes in some indices of fluid and electrolyte metabolism in the readaptation period. Author

N78-22673# Joint Publications Research Service, Arlington, Va.

CLINICAL ASPECTS OF CHANGES IN THE NERVOUS SYSTEM IN THE COURSE OF 49-DAY ANTIORTHOSTATIC HYPOKINESIA **c52**

T. N. Krupina and A. Ya. Tizul *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 32-38 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 26-31 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

The condition of the nervous system of nine individuals ranging in age from 20 to 35 years was studied in the course of 49-day antiorthostatic hypokinesia. In addition to clinical tests, thermoregulation and the muscular system were monitored once every 7-10 days. Subjects were questioned about their well-being daily. Author

N78-22674# Joint Publications Research Service, Arlington, Va.

STATE OF RAT MUSCLE MOTONEURON SYSTEM IN THE CASE OF RESTRICTED MOBILITY

Ye. I. Ilina-Kakuyeva and V. V. Portugalov *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 39-44 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 31-35 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

The condition of motor elements (nerves) in muscles subjected to hypokinesia is discussed. Atrophying muscles in astronauts due to lack of physical exercise and weightlessness are also considered. J.A.M.

N78-22675# Joint Publications Research Service, Arlington, Va.

EFFECT OF PHYSICAL LOADS ON SOME PARAMETERS OF LIPID AND CARBOHYDRATE METABOLISM DURING HYPOKINESIA **c52**

T. M. Lobova and A. V. Chernyy *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 45-51 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 36-40 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

For studies of lipid and carbohydrate metabolism, experiments were conducted on 140 white, male rats weighing 150-230g with different amounts of motor activity. The first group of animals was on an unrestricted regimen, in ordinary vivarium cages, with 5 animals in each; the second group was on an unrestricted regiment with measured physical exercise (swimming at 30-32 deg temperature). The third group of animals was kept in small cages that restricted mobility; in the fourth group, hypokinesia was combined with swimming, following a regimen analogous to the one of the second group. Author

N78-22676# Joint Publications Research Service, Arlington, Va.

CIRCADIAN CHANGES IN ACTIVITY OF THE HYPOTHALAMUS-HYPOPHYSIS-ADRENAL SYSTEM IN ANIMALS DIFFERING IN INDIVIDUAL RADIO-SENSITIVITY

Yu. P. Druzhinin, Ye. I. Zubkova-Mikhaylova, and G. N. Podluzhnaya *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 52-58 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 40-45 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

A study was undertaken to determine the activity of the hypothalamus-hypophysis-adrenal system at different times of day in specimens differing in sensitivity to acute radiation. The epinephrine test was used to select two groups of animals differing in radiosensitivity. These tests were conducted on male Wistar rats weighing 180-200g. J.A.M.

N78-22677# Joint Publications Research Service, Arlington, Va.

FUNCTIONAL STATE OF THE RAT LIVER UNDER THE PRIMARY DELETERIOUS EFFECT OF IMPACT ACCELERATIONS

Ye. Ye. Simonov and K. B. Ryklin *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 59-65 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 45-50 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

A parallel study of histology and histochemistry of the liver was conducted for animals exposed to impact accelerations of landing that did not elicit primary damage in the lungs. Along with the histological and histochemical study of hepatic tissue of experimental animals, biochemical composition of blood was also examined. Experiments were conducted on 184 male albino rats weighing 150 to 300 g, 40 of which served as a biological control, while the rest were divided into two almost equal experimental groups and exposed to impact accelerations in the back-chest direction on a special stand. [1,5]. The landing rate constituted 3 m/s and accelerations constituted 410 plus or minus 50 units (U) in the first experimental group, 10 m/s and 465 plus or minus 50 U, respectively, in the second. Author

N78-22678# Joint Publications Research Service, Arlington, Va.

MODEL OF MOTION SICKNESS IN DOGS USED TO EVALUATE EFFICACY OF PHARMACOLOGICAL AGENTS

L. A. Radkevich *In its* Space Biol. and Aerospace Med., V. 11 No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 66-69 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 50-53 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

The task was undertaken of creating conditions for inducing motion sickness in dogs, under which the occurring accelerations would affect as many as possible of the receptor elements of the vestibular system, thus inducing maximum accumulation of stimuli. Several agents were tested on the selected group of animals susceptible to motion sickness: marezine, an antihistamine (50 mg/kg); tigan, bromotigan (100 mg/kg), as well as metachlorpromide (1 mg/kg), which are antiemetics; diphenidol (2 mg/kg), a cholinolytic, and a few other products. These studies warrant the conclusion that products in the cholinolytic group and, to a lesser extent, antihistamines have protective properties with regard to canine motion sickness. A similar effect was obtained in studies on humans with the use of these groups of products. This confirms the fact that dogs are quite suitable biological objects for preliminary screening of pharmacological agents that prevent motion sickness. Author

N78-22679# Joint Publications Research Service, Arlington, Va.

HYGIENIC APPRAISAL OF WATER REGENERATED FROM

DIVERSE FLUID-CONTAINING WASTE **c54**

Z. P. Pak, Yu. S. Koloskova, and S. V. Chizhov *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 75-82 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 57-63 (For availability see N78-22668 13-51)

Avail: NTIS HC A07/MF A01

The results are given of a comprehensive hygienic evaluation of diverse specimens of regenerated water, according to the findings of physiochemical and organeleptic studies as well as investigation of physiological effects of this factor on fluid and mineral metabolism in man. Author

N78-22680# Joint Publications Research Service, Arlington, Va.

VARIANTS OF CONTROL FOR AN ECOSYSTEM THAT IS CLOSED WITH REGARD TO EXCHANGE OF GASES, WITH PERIODICALLY FUNCTIONING AUTOTROPHIC COMPONENT **c54**

V. G. Shabelnikov *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 83-89 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 63-68 (For availability see N78-22668 13-51)

Avail: NTIS HC A07/MF A01

A study is continued of the possibility of controlling an ecosystem, closed with respect to gas exchange, by means of periodic function of an autotrophic component. The objective of such control is to maintain a stable atmosphere in the ecosystem, the composition of which changes periodically but always remains within the range tolerated by man. Author

N78-22681# Joint Publications Research Service, Arlington, Va.

EFFECT OF SEDUXEN ON THE COURSE OF EXPERIMENTAL HYPOKINESIA **c52**

L. V. Zorya *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 90-97 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 68-73 (For availability see N78-22668 13-51)

Avail: NTIS HC A07/MF A01

The pathological changes occurring with hypokinesia are related in certain ways to the time and conditions under which it is induced. Thus, it is believed that the functional changes observed for the first 2 weeks of limited movement are aggravated, by the effects of emotional stress on the animal or human organism. Of all the reactions of the organisms to restricted mobility, impairment of oxygen balance plays a rather significant role, and it is also manifested the most distinctly in the first 16 days of hypokinesia. On the basis of these considerations, seduxen was used to remove emotional stress and, at the same time, normalize disturbances referable to oxygen balance. According to the literature, this drug has both tranquilizing-sedative and antihypoxic properties. Author

N78-22682# Joint Publications Research Service, Arlington, Va.

EFFECTS ON THE HUMAN BODY OF COMPLEX TESTS SIMULATING FLIGHT CONDITIONS ON THE SALYUT-4 SPACECRAFT **c52**

V. P. Dzedzichek, N. Ye. Panferova, and Ye. V. Kukolevskaya *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 98-101 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 74-75 (For availability see N78-22668 13-51)

Avail: NTIS HC A07/MF A01

The studies were conducted in a spacecraft mockup. The living conditions were made as similar as possible to inflight conditions. There were two male participants in tests lasting 50 days. During the tests, the pulse rate of the subjects was counted every 3 hrs, arterial pressure was measured twice a day. A functional test, 40 squats/90 s, was performed every 2 days. The subjects performed physical exercises, the amount of which was adjusted to the inflight level. The volume of the foot was measured in seated position and while standing for 1.5 min, before and after the tests, using a water plethysmometer. Determination was made of rate of propagation of the pulse wave in seven parts of the vascular system. The capillaroscopic appearance of the eponychium of the 4th finger and first toe was examined. A passive 20-min orthostatic test and a test on a bicycle ergometer with stepped up increase in load were conducted. The subject's well-being was satisfactory during the tests. They adapted to the conditions by the 6th-10th day, which is consistent with the time of adaptation to flight conditions. Author

N78-22683# Joint Publications Research Service, Arlington, Va.

MORPHOLOGY OF BONE MARROW CELLS OF RATS ON THE KOSMOS-605 BIOSATELLITE

V. N. Shuets and N. P. Krivenkova *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 102-105 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 75-78 (For availability see N78-22668 13-51)

Avail: NTIS HC A07/MF A01

A study was done of bone marrow morphology in rats who had spent 22 days in flight on the Kosmos-605 biosatellite and examined on the 2d and 27th day after landing. In order to study the size of the population of hemopoietic stem cells in rats that had been in orbital flight, the method of cultivation of bone marrow cells in the organism of lethally irradiated animals Cs-137 gamma rays, were used. For this purpose, (CBAxC57B1)F1 mice and Wistar rats were exposed to Cs-137 gamma rays, in a dosage of 900 R delivered at the rate of 37 R/min. One day after irradiation, recipients were given intravenous injections of a suspension of bone marrow cells taken from rats on the 2d and 27th day after a 22-day flight onboard Kosmos-605. It was found that only negligible changes, manifested by depression of erythoblasts and appearance of altered megakaryocytes, occur in the bone marrow cells of rats following a 22-day space flight. Author

N78-22684# Joint Publications Research Service, Arlington, Va.

BLOOD PLASMA CORTICOSTERONE IN RATS AFTER FLIGHT IN KOSMOS-690 BIOSATELLITE

N. F. Kalita and R. A. Tigranyan *In its* Space Biol. and Aerospace Med., V. 11 No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 106-107 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 78-79 (For availability see N78-22668 13-51)

Avail: NTIS HC A07/MF A01

Data are given from studies of corticosterone concentration in blood plasma of rats after completion of a 20.5-day space experiment in the Kosmos-690 biosatellite. The studies indicate that exposure to 800 rad gamma-radiation under space flight conditions does not induce significant changes in blood plasma corticosterone content, whereas exposure to low doses (220 rad) is associated with a reliable increase in concentration of this hormone in blood. Author

N78-22685# Joint Publications Research Service, Arlington, Va.

EXCITABILITY OF NEUROMUSCULAR SYSTEM OF MONKEYS DURING ORTHOSTATIC TESTS

G. S. Belkaniya *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 108-112 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 79-81 (For availability see N78-22668 13-51)

Avail: NTIS HC A07/MF A01

The monosynaptic H-reflex was studied in 15 Macaca rhesus monkeys. The animals were immobilized on the platform of a turntable on their abdomen. Square-wave pulses lasting 0.05-0.1 ms delivered by an electronic stimulator were used to stimulate the tibial nerve. The active spherical electrode was secured in the popliteal fossa and the silent (positive) plate electrode was placed on the shaved anterior aspect of the thigh. The studies revealed that the method of monosynaptic testing (H-reflex) on monkeys is quite informative. One of the real manifestations of antigravity function in them is the increase in excitability of motoneurons and number of activated motor units. Intensification of functional activity of the neuromuscular system, induced by orthostatic orientation of the body in space, is one

of the chief factors providing for a certain level of background activation of central nervous structures and organization of antigravity function of the organism. Author

N78-22686# Joint Publications Research Service, Arlington, Va.
SANITARY AND HYGIENIC EVALUATION OF WATER REGENERATED FROM URINE **c54**
N. I. Omelyanets, L. I. Artemenko, L. P. Vlasova, N. V. Martyshchenko, and S. I. Nozdrachev *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 113-117 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 82-84 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

Regeneration of water by means of freezing and subsequent additional treatment by the sorption method, addition of salts and decontamination with ionic silver yields water from human urine, which meets the sanitary and hygienic requirements for potable water. The obtained results are consistent with the data's previous investigations. On the basis of these studies, this technological system is recommended to provide water for crews of spacecraft. Author

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-22687 Stanford Univ., Calif.
NONINVASIVE DETERMINATION OF BONE STIFFNESS Ph.D. Thesis
Kent Roy Petersen 1977 216 p
Avail: Univ. Microfilms Order No. 78-02216

A low frequency impedance probe method for the determination of the bending stiffness of the long bones was developed. The arm or leg was constrained at each end, a transverse harmonic force was applied near the midspan, and the driving point impedance was measured. Initial experiments on monkey arm specimens demonstrated that the soft tissue between the probe and the bone was causing typical errors of 30 to 70 percent in the determination of the bone stiffness. This unpredictable response or masking effect of the soft tissue was the major problem which prevented previous investigators from developing a noninvasive method. This problem was solved by modifying the shape of the impedance probe, improving the supports, and using appropriate data analysis. The typical error in determining the bone stiffness was reduced to less than 15 percent with possibilities for future improvement. Dissert. Abstr.

N78-22688 Wyoming Univ., Laramie.
SPECTRAL ANALYSIS OF AUDITORY EVOKED POTENTIALS WITH PSEUDORANDOM NOISE EXCITATION Ph.D. Thesis
Sarabudla Narasimha Reddy 1977 153 p
Avail: Univ. Microfilms Order No. 78-00178

There is a great demand to test human auditory system with complex signals rather than pure-tones, as is often done, and to clarify the neurological and audiological aspects of the information so obtained. Pseudorandom noise (PRN) of various bandwidths was used in testing four normal and three hearing impaired subjects by means of auditory evoked potentials. Taking advantage of the advanced computers and signal processing techniques now available, the evoked potentials were studied in the frequency domain rather than the time domain. The power spectral densities of the audio PRN stimuli and their respective evoked potentials were obtained by means of spectral analysis. Transfer and coherence functions were also obtained.
Dissert. Abstr.

N78-22689 Marquette Univ., Milwaukee, Wis.
A MULTIPLE INDICATOR-DILUTION STUDY OF TRANSPORT AND METABOLIC PROCESSES IN THE LUNG Ph.D. Thesis
Michael Richard Prisco 1977 168 p
Avail: Univ. Microfilms Order No. 78-01929

A mathematical model which describes both diffusional and saturable uptake of a permeating substance and subsequent metabolism in the extravascular space of an organ was derived. This model of saturable uptake and metabolism describes the space and time variations of the concentrations of a permeating substance and its metabolite in both the vascular and extravascular spaces. A numerical technique was presented for the solution of the model which consists of four nonlinear partial differential equations. An experiment involving prostaglandin E1 PGE1 was analyzed using the modeling developed in this study. This analysis has afforded some insight into the nature of the PGE1 uptake process in the cat lung as well as an estimate of the kinetic constants for uptake and metabolism. Using these constants, model simulations of experiments performed at varying doses and blood flow rates were carried out. Dissert. Abstr.

N78-22690 New York Univ., N. Y.
THE EFFECT OF VARIOUS AUGMENTED VISUAL FEEDBACK TECHNIQUES ON ADULT SKELETAL MUSCLE Ph.D. Thesis
Raymond Louis Blakely 1977 142 p
Avail: Univ. Microfilms Order No. 78-03002

The training effect of various visual feedback methods on a muscle in which the neuromotor mechanisms are intact, but the muscle is not normally under voluntary control was determined by training the abductor digiti minimi of the nondominant foot of 60 volunteers. The following feedback methods were used: electromyographic signals displayed on an oscilloscope, reflected image from a mirror, direct visual feedback without biomechanical or bioelectrical devices, and no visual feedback. All four visual feedback methods resulted in a significant difference at the 0.05 level between group mean pretraining and group mean posttraining scores. Dissert. Abstr.

N78-22691 Missouri Univ., Columbia.
COMPARISON OF BLOOD FLOW IN NORMAL SUBJECTS DURING APPLICATIONS OF HEAT, COLD, AND EXERCISE AT THERAPEUTIC LEVELS Ph.D. Thesis
Kenneth Lloyd Knight 1977 257 p
Avail: Univ. Microfilms Order No. 7803730

There was a significant exercise effect and a significant temperature effect for both total blood flow and minimum blood flow, and a significant exercise effect for peak blood flow. Within non exercise there was a temperature effect, however, there was not a temperature effect within exercise. Heat applications caused an increase in both peak and total blood flow. Cold caused a decrease in blood flow during the 25 minute cold pack application and during the 20 minute post-application period. Both total blood flow and peak blood flow were significantly greater during cold exercise cryokinetics, than during heat applications. Dissert. Abstr.

N78-22692 Maryland Univ., Baltimore.
THE ORGANIZATION AND AUTONOMIC INNERVATION OF THE VASCULAR SYSTEM OF THE MAMMALIAN SPINAL CORD; AN ULTRASTRUCTURAL STUDY Ph.D. Thesis
Juanita J. Anders 1976 235 p
Avail: Univ. Microfilms Order No. 78-00650

There have been no systematic ultrastructural examinations of either the vasculature of the spinal cord or of the autonomic innervation of these vessels, in spite of their importance to current investigation on blood flow in the spinal cord, spinal cord injury and possible functional regeneration after injury. Electron microscopic techniques were applied to a survey of the vessels comprising this system and to an analysis of their autonomic innervation. The widespread distribution of autonomic innervation to all types of vessels supplying the spinal cord suggests that autonomic neurovascular influences on the spinal vasculature may be correspondingly broad. The role that these autonomic nerves may play in the dynamic or tonic regulation of extrinsic and intrinsic vessels of the spinal cord is of great potential importance. Dissert. Abstr.

N78-22693 Rutgers - The State Univ., New Brunswick, N. J.
MODEL-BASED HEMODYNAMIC INDICATORS OF LEFT VENTRICULAR PERFORMANCE IN ACUTE MYOCARDIAL INFARCTION Ph.D. Thesis
Yasha M. Kresh 1977 234 p

Avail: Univ. Microfilms Order No. 7805098

A mathematical equivalent pressure source model for the pumping left ventricle was adopted. The generator pressure and the internal source impedance were computed experimentally from hemodynamic measurements of the left ventricular pressure and flow. Analytical techniques and experimental methods were developed which assessed the function of the heart as a pulsating pump independently of the aortic input impedance. The analytical performance indicators were computed from a sequential analysis of the source parameters in progressive acute myocardial infarction. The pump performance status as predicted analytically was compared to the corresponding set of measurable parameters suggested by the model. Dissert. Abstr.

N78-22694 Ohio State Univ., Columbus.
A CARDIAC ARRHYTHMIA MONITORING SYSTEM Ph.D. Thesis
Michael Ralph Kramer 1977 321 p
Avail: Univ. Microfilms Order No. 7805872

The R-R histogram monitoring system enabled the patient to be monitored during his daily routine. The system provided both graphic and numerical information concerning the cardiac rhythm. This information was used to determine the type and the frequency of the arrhythmias that were present. Four R-R histogram data collection units were built and tested for accuracy using clinical data. The results indicated an overall accuracy of approximately 95%. Dissert. Abstr.

N78-22695 Iowa State Univ. of Science and Technology, Ames.
NONINVASIVE, REAL-TIME EXAMINATION OF ATRIO-VENTRICULAR CONDUCTION SYSTEM Ph.D. Thesis
Masayuki Ishijima 1977 154 p
Avail: Univ. Microfilms Order No. 78-05941

The theoretical aspects and the limitations of the noninvasive method for examining the bundle of His activity are discussed. The bundle of His activity, as represented by the H complex of the His bundle electrogram, was modeled. The calculated waveforms had agreement with those which were actually obtained by a catheter electrode. In the calculations which pertained to the H complex, the size of the ring electrode on the catheter, the nonlinear velocity of the depolarization wavefront, and the effect of the bandpass filter were also considered. Dissert. Abstr.

N78-22696*# Washington Univ., Seattle. Div. of Nuclear Medicine.
TOTAL BODY CALCIUM ANALYSIS USING THE Ca-12(n, ALPHA) Ar-37 REACTION Final Technical Report, 1 Oct. 1976 - 1 Dec. 1977
T. K. Lewellen and Wil B. Nelp 1 Dec. 1977 31 p refs (Contract NAS9-13029)
(NASA-CR-151675) Avail: NTIS HC A03/MF A01 CSCL 06P

A low dose neutron activation technique was developed to measure total body calcium in vivo. The effort had included development of irradiation and processing facilities and conduction of human studies to determine the accuracy and precision of measurement attainable with the systems. Author

N78-22697# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF THE BENZODIAZEPINE ADUMBRAN ON THE RESTING AND SLEEP EEG AND ON THE VISUAL EVOKED POTENTIAL IN ADULT MAN
G. Dolce and E. Kaemmerer Oct. 1976 14 p refs Transl. into ENGLISH from Med. Welt (West Ger.), v. 67, no. 9, 1967 p 510-514
(RAE-Lib-Trans-1906; BR55679) Avail: NTIS HC A02/MF A01; HMSO:PHI

The administration of 20 to 40mg of Adumbran to 27 adults gave rise to no significant clinical changes in vigilance in the waking state and no appreciable change in the EEG pattern, particularly as regards frequency. In tests to determine psychic disturbances after eliminating or shortening paradoxical sleep, the effect of Adumbran on the sleep EEG was recorded polygraphically. The overall duration of sleep lengthened under medication, with a simultaneous intensification of slow sleep. Paradoxical sleep was only shortened by an insignificant amount and was not suppressed. The visual evoked potential suffered only a slight reduction in amplitude, while there was no appreciable increase in latency. Author

N78-22698# Institut de Mecanique des Fluides de Toulouse (France). Groupe de Rheologie.
A MODEL OF BLOOD FLOWS STUDIES
D. P. Ly, D. Bellet, Y. Fanjeau, and A. Bousquet 1977 17 p refs Presented at the Intern. Conf. on Bioeng., Cape Town, Apr. 1977
Avail: NTIS HC A02/MF A01

The typical effects of a conical geometry of a duct were studied. This particular geometry was chosen owing to the common occurrence of the reduction of blood vessel diameter as one moves away from the heart and an increase in diameter just before a bifurcation. The regular variation of the useful flow area in the different cases was taken into consideration. Pressure gradients were obtained by the superposition of a constant component and a fluctuative component which was a sinusoidal function of time. The determination of velocity profiles in different sections and the flow rates were made at different instants with the aid of two complementary methods: a theoretical method, based on perturbations leading to analytical solutions, and an experimental method using a laser anemometer. The aqueous solutions at different concentrations of high polymers were used to simulate blood. Author

N78-22699# Fachhochschule, Munich (West Germany).
PRESSURE MEASUREMENTS OF THE WALL AFTER BIFURCATIONS AND VISUAL OBSERVATION OF STREAMING FLUID IN GLASS MODELS OF BIFURCATIONS
Dieter Liepsch 1977 16 p refs Presented at the Intern. Conf. on Bioeng., Cape Town, Apr. 1977
Avail: NTIS HC A02/MF A01

A model consisting of a continuous tube with two branching tubes, one behind the other, was used to simulate branching conditions in the human arterial system. Flow conditions of a birefringent solution were observed with the aid of a tension optical apparatus. The static pressure on the wall of the continuous tube was measured before and after the branching tubes. Immediately after the ramification a sudden increase of pressure occurs in the continuous tube, depending on the flow rate. In the circulatory system this zone of higher static pressure can stress the artery walls and in some cases lead to wall damage and increased particle deposition. Author

N78-22700# Cape Town Univ. (South Africa). Dept. of Bioengineering.
THE INFLUENCE OF STRAIN RATE ON THE MECHANICAL PROPERTIES OF HUMAN SKIN AND SUBCUTANEOUS TISSUE
J. F. North 1977 13 p refs Presented at the Intern. Conf. on Bioeng., Cape Town, Apr. 1977
Avail: NTIS HC A02/MF A01

The influence of strain rate on the mechanical properties of human skin and subcutaneous tissue were investigated. Tests were carried out using a drop tower and a hydraulic testing machine. Strain rates from 0.03 to 1500/s were examined and stress-strain profiles are presented. Human skin and subcutaneous tissue were strain rate sensitive within the range examined and possessed definite load distribution and energy absorption properties. The importance of structural integrity and the interaction of tissues resisting mechanical forces is emphasized. Author

N78-22701# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
SIMULATION RESPONSES OF A CONTROL MODEL OF HUMAN SKELETAL MUSCLE
H. Hatze 1977 9 p refs Presented at the Intern. Conf. on Bioeng., Cape Town, Apr. 1977
Avail: NTIS HC A02/MF A01

Results are presented of the simulation of isometric force development of skeletal muscle when the stimulation is switched on and off abruptly, i.e. when bang-bang controls are applied. It is shown that the resulting forcing function is continuous and exhibits all the special features of isometric force production observed experimentally. It is suggested that the present control

model of skeletal muscle is well suited for inclusion in a more complex model of the human musculoskeletal system. Author

N78-22702# Tel-Aviv Univ. (Israel). School of Engineering.
A NEW METHOD FOR DETERMINING THE ACTIVE FORCE SYSTEM IN LOWER LIMBS DURING HUMAN LOCOMOTION
M. Arcan, M. A. Brull, R. Scholten (G.m.b.H., Friedrichshafen, West Germany), and H. Rohrle (G.m.b.H., Friedrichshafen, West Germany) 1977 18 p refs Presented at the Intern. Conf. on Bioeng., Cape Town, Apr. 1977
Avail: NTIS HC A02/MF A01

The method for measuring the contact pressure distribution between the foot and the ground was extended to gait and locomotion analysis; and the foot-ground pressure pattern characteristics were related to the kinematics of the body. A method for calculating muscle forces based on logical physical assumptions is presented. Author

N78-22703# Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
MODELLING THE THERMAL EFFECTS OF BLOOD FLOW IN HUMAN SKIN
A. M. Patterson 1977 11 p refs Presented at the Intern. Conf. on Bioeng., Cape Town, Apr. 1977
Avail: NTIS HC A02/MF A01

Existing models of the thermal behavior of human skin are briefly reviewed. The availability of precisely measured temperature profiles taken from the outer 2 to 3 mm of skin of a human forearm has made possible an analytical model relating such variables as skin blood flow, skin surface heat loss, skin surface temperature, and other geometrical and thermal parameters. Agreement was obtained between experimental data and numerical evaluations of model predictions. Author

N78-22704# Witwatersrand Univ., Johannesburg (South Africa).
DYSFUNCTIONING OF THE FLUID MECHANICAL CRANIOSPINAL SYSTEMS AS REVEALED BY STRESS/STRAIN DIAGRAMS
K. Lewer Allen and E. A. Bunt 1977 21 p refs Presented at the Intern. Conf. on Bioeng., Cape Town, Apr. 1977
Avail: NTIS HC A02/MF A01

The functioning of the two fluid mechanical systems of the brain; the cerebrospinal fluid and cerebral vascular, were related to their pressure levels and outflow control. Information is presented concerning both normal and pathological functioning of these systems which can be derived from stress-strain diagrams of the human brain, making use of either a lumbar puncture or a ventricular tapping. Author

N78-22705*# Massachusetts General Hospital, Boston.
ZERO GRAVITY AND CARDIOVASCULAR HOMEOSTASIS. THE RELATIONSHIP BETWEEN ENDOGENOUS HYPERPROLACTINEMIA AND PLASMA ALDOSTERONE Summary Report, 1 Feb. 1977 - 31 Jan. 1978
Edgar Haber, Richard N. Re, Ione A. Kourides, Albert C. Weihl, and Farahe Maloof 31 Jan. 1978 22 p refs
(Contract NAS9-15182)
(NASA-CR-151715) Avail: NTIS HC A02/MF A01 CSCL 06S

Prolactin, thyrotropin and aldosterone were measured by radioimmunoassay and plasma renin activity by the radioimmunoassay of angiotensin I in normal women before and after the intravenous injection of 200 micrograms of thyrotropin releasing hormone. Prolactin increased at 15 minutes following thyrotropin releasing hormone. Plasma renin activity was not different from control levels during the first hour following the administration of thyrotropin releasing hormone, nor did the plasma aldosterone concentration differ significantly from the control levels during this period. However, with upright posture, an increase in aldosterone and in plasma renin activity was noted, demonstrating a normal capacity to secrete aldosterone. Similarly, no change in aldosterone was seen in 9 patients with primary hypothyroidism given thyrotropin releasing hormone, despite the fact that the increase in prolactin was greater than normal. These data demonstrate that acutely or chronically elevated serum prolactin levels do not result in increased plasma aldosterone levels in humans. Author

N78-22706# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE EFFECTS OF STIMULUS ORIENTATION AND RESPONSE BIAS UPON DYNAMIC VISUAL ACUITY Interim Report
Lawrence H. Frank 19 Aug. 1977 19 p refs
(AD-A047827; NAMRL-1241) Avail: NTIS HC A02/MF A01 CSCL 05/10

In experiments on dynamic visual acuity, test stimuli are characteristically presented in various orientations to the subject as they are moved across his visual field. However, current literature on static visual acuity indicates that acuity thresholds vary as a function of stimulus orientation. Static acuity thresholds are reported to be lower for the vertical and horizontal orientations, whereas, higher thresholds are found for oblique orientations. This has been referred to as the 'oblique effect.' It is not known whether the same phenomenon operates in dynamic visual acuity. Hence, it is of interest to determine whether such an effect occurs under moving target conditions. The present studies utilized the up-and-down method to determine acuity thresholds for eight orientations (4 cardinal and 4 oblique) of Landolt Cs over three angular velocities. Response-bias scores were computed for each subject and compared to the threshold data. A significant orientation effect was found for both dynamically and statically presented targets, but it was not an oblique effect. That is, thresholds were not consistently higher for oblique orientations. The data further revealed a significant negative rank-order correlation between the subject's response-bias scores and their threshold scores across orientations, for dynamically presented targets. The data were suggestive that a subject's response bias contributes to the error in the measurement of psychophysically derived acuity thresholds. Author (GRA)

N78-22707# Army Research Inst. of Environmental Medicine, Natick, Mass.
DEVELOPMENT AND EVALUATION OF HEAT TRANSFER EQUATIONS FOR A MODEL OF CLOTHED MAN
J. M. Stewart and R. F. Goldman Mar. 1977 20 p
(DA Proj. 3E7-62777-AB-45)
(AD-A050542; USARIEM-M-10/77) Avail: NTIS HC A02/MF A01 CSCL 06/19

Two equations have been derived for heat transfer from a cylinder. The cylinder had a wet surface and was wrapped with a layer having uniform properties. One equation is a special case of the other, a more general equation. The equation for the special case is equivalent to equations currently being used to describe heat transfer from clothed men. The special case implies that current equations are valid when sweat evaporates at the body skin surface only, i.e. no evaporation may occur at the clothing surface. Both (forms of the) equations gave good representation of the steady state data which were obtained from studies on a clothed, heated manikin with either a wet or dry skin ($r = 0.99$). The clothing resembled industrial clothing. Skin (and hence clothing) wetness increased the conductance of sensible heat by 32%. Failure to account for this effect caused insensible heat transfer to be underestimated by 13% and a systematic error was introduced into the prediction of total heat transfer. Author (GRA)

N78-22708# Franklin Inst. Research Labs., Philadelphia, Pa.
COMPUTER SIMULATION OF HUMAN THORACIC SKELETAL RESPONSE: ABSTRACT SUMMARY REPORT Final Report, 26 Jun. 1975 - 31 Jan. 1977
M. M. Reddi and H. C. Tsai Feb. 1977 25 p
(Contract DOT-HS-5-01180)
(PB-276705/1; FIRL-F-C4216-1; DOT-HS-803208) Avail: NTIS HC A02/MF A01 CSCL 13F

The work consisted of a study and selection of techniques to simulate rib fracture, restraint systems, and experimental constraints as well as a total of five simulations of actual cadaver experiments consisting of three with impactors, one with belt restraints and one with an air bag equipped energy absorbing steering column. GRA

N78-22709# Franklin Inst. Research Labs., Philadelphia, Pa.
COMPUTER SIMULATION OF HUMAN THORACIC SKELETAL RESPONSE-THEORY, VOLUME 1 Final Report, 26 Jun. 1975 - 31 Jan. 1977

M. M. Reddi and H. C. Tsai Feb. 1977 224 p refs
(Contract DOT-HS-5-01180)
(PB-276706/9; FIRL-F-C4216-1-Vol-1; DOT-HS-803209-Vol-1)
Avail: NTIS HC A10/MF A01 CSCL 13F
For abstract, see N78-22708.

N78-22710# Health Effects Research Lab., Research Triangle Park, N. C. Clinical Studies Div.
HUMAN EXPOSURE SYSTEM FOR CONTROLLED OZONE ATMOSPHERES
Arthur A. Strong Oct. 1977 24 p refs
(PB-276618/6; EPA-600/1-77-048) Avail: NTIS HC A02/MF A01 CSCL 06B

An experimental exposure system for health effects research in environmental pollutants that permits the introduction and control of ozone (O3) to an acrylic plastic chamber in which a human subject actively resides is described. Ozone is introduced into the chamber air intake and is controlled by an electro-mechanical feedback system operating from the electrical output of an O3 gas analyzer. A continuous record of O3 concentration, temperature, and dew point is provided by an analog multipoint strip chart recorder. If the chamber O3 levels exceed preset limits, an alarm system automatically stops the O3 flow and switches the chamber exhaust to purge operation. A complete air exchange occurs every 72 seconds. In an emergency, the chamber can be purged in 190 seconds. Chamber temperature and humidity are dependent upon conditioned laboratory air. GRA

N78-22711# Unilever Research, Vlaardingen (Netherlands).
DIETARY FATS AND ARTERIAL THROMBOSIS: EFFECTS AND MECHANISM OF ACTION
Gerard Hornstra [1977] 27 p refs Submitted for publication
Avail: NTIS HC A03/MF A01

Dietary fats have a pronounced effect on arterial thrombosis: in rats, long-chain saturated fatty acids are thrombogenic, oleic acid is neutral, and linoleic acid is anti-thrombotic. These effects are likely to be mediated, at least in part, by changes in platelet fatty acid composition and, consequently, platelet function. Blood coagulability and differences in vitamin E intake seem of no (or minor) importance. In man, dietary linoleic acid inhibits platelet aggregation and other parameters of platelet activation. Dietary fat effects on vascular prostacyclin formation have not yet been found. Author (ESA)

N78-22712# Syracuse Research Corp., N. Y. Center for Chemical Hazard Assessment.
INFORMATION PROFILES ON POTENTIAL OCCUPATIONAL HAZARDS
Jane E. Hoecker, Patrick R. Durkin, Arnold Hanchett, Leslie N. Davis, William M. Meylan, and Stephen J. Bosch Oct. 1977 334 p refs
(Contract PHS-NIOSH-210-77-0120)
(PB-276678/0; TR-75-565; TR-77-565; NIOSH-210-77-0120)
Avail: NTIS HC A15/MF A01 CSCL 06J

Information profiles on potential occupational hazards of a series of chemical compounds and industrial processes are presented in the form of data sheets describing chemical structures, biological effects, human effects, exposure limits, prevailing standards, etc. Chemical compounds covered are: benzyl choride; carbon black; furfuryl alcohol; hexachlorocyclopentadiene; hexafluoroacetone; hydrogene chloride gas; methyl chloride; 2-butanone peroxide; oxalic acid; ozone; talc; vinyl cyclohexene dioxide; wood dust; boron and its compounds; brominated aromatic compounds; cobalt and its compounds; fumigants; glycidyl ethers; inorganic azides; and inorganic chromium compounds. GRA

N78-22713# Mount Sinai School of Medicine, N. Y. Dept. of Pediatrics.
APPLICATION TO ANIMALS AND HUMANS OF A CONTINUOUS MONITORING OXYGEN SYSTEM Final Report, 15 May 1975 - 15 Aug. 1977
Edwin G. Brown Jan. 1978 95 p refs
(Contract N01-HR-5-2949)
(PB-276448/8; NIH-N01-HR-52949-1F) Avail: NTIS HC A05/MF A01 CSCL 06K

A useful polarographic oxygen tension (PO2) sensing electrode system was constructed by the incorporation of a sensing electrode (cathode) in the wall of an intravascular catheter. The reference electrode (anode) is located in the Luer hub of the catheter remote from the sensing electrode. Electrical continuity between the cathode and anode is maintained by an electrolyte solution contained within the central lumen of the catheter. The device can accurately and continuously monitor changes in oxygen tension. Use of the sensor in a limited number of adults and newborn infants indicates that it reliably and accurately measures intravascular oxygen tension. GRA

N78-22714 Minnesota Univ., Minneapolis.
OSMOTIC RELATIONSHIPS BETWEEN BLOOD, CEREBROSPINAL FLUID AND INNER EAR FLUIDS Ph.D. Thesis
Sergio Aquirre Prado 1977 110 p
Avail: Univ. Microfilms Order No. 7802732

The osmotic relations among blood, cerebrospinal fluid (CSF), and perilymph was established in experimental animals by quantitative analyses of osmotic pressure under various experimental conditions. The results obtained by animal experiments served as baseline information to evaluate the effect of the alteration of blood or CSF composition on the inner ear fluid homeostasis in clinical conditions. An hypothesis of disturbances on inner ear fluids microhomeostasis by osmotic imbalance as a possible mechanism for the production of endolymphatic hydrops is presented. Dissert. Abstr.

N78-22567# Israeli Program for Scientific Translations Ltd., Jerusalem.
PERIODIC ACTIVITY OF NATURAL FOCI OF PLAGUE AND ITS CAUSES
A. A. Lavrovskii *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 74-81 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

N78-22568# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE EPIDEMIC PROCESS AS A FUNCTION OF SOLAR ACTIVITY
V. N. Yagodinskii, Z. P. Konovalenko, and I. P. Druzhinin *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 82-103 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
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N78-22569# Israeli Program for Scientific Translations Ltd., Jerusalem.
EFFECT OF HELIOGEOPHYSICAL FACTORS ON THE EVOLUTION OF INFECTIOUS DISEASES OF MAN
V. E. Stadolnik *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 104-110 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
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N78-22575# Israeli Program for Scientific Translations Ltd., Jerusalem.
SOLAR ACTIVITY AND CARDIOVASCULAR DISEASES
K. F. Novikova and B. A. Ryvkin *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 184-200 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

N78-22576# Israeli Program for Scientific Translations Ltd., Jerusalem.
SUDDEN DEATH FROM CARDIOVASCULAR DISEASES AND SOLAR ACTIVITY
M. N. Gnevyshev, K. F. Novikova, A. I. Ol, and N. V. Tokareva *In its* Effects of Solar Activity on the Earth's Atmosphere and

Biosphere (TT-75-50015) 1977 p 201-210 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

N78-22577# Israeli Program for Scientific Translations Ltd., Jerusalem.
SOLAR ACTIVITY AND THE VARIATION OF BLOOD COAGULATION BETWEEN 1949 AND 1966
A. T. Platonova *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 215-217 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

N78-22578# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE INFLUENCE OF SOLAR ACTIVITY ON THE FIBRINOLYTIC SYSTEM OF THE BLOOD
E. D. Rozhdestvenskaya and K. F. Novikova *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 218-223 ref Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

N78-22579# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE MECHANISM OF THE INFLUENCE OF SOLAR-ACTIVITY OSCILLATIONS ON THE HUMAN ORGANISM
A. Osipov and V. P. Desyatov *In its* Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 232-237 refs Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

N78-22599# Washington Univ., Seattle. Bioelectromagnetics Research Lab.
QUANTITATION OF MICROWAVE BIOLOGICAL EFFECTS
Chung-Kwang Chou and Arthur W. Guy *In* Bur. of Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 81-103 refs (For availability see N78-22591 13-51)
(Grants FD-00646; CA-05681-01)
Avail: NTIS MF A01; SOD HC

N78-22601# Maryland Univ., College Park. Inst. for Physical Science and Technology.
ELECTRIC FIELD MEASUREMENTS WITHIN BIOLOGICAL MEDIA
A. Y. Cheung *In* Bur. of Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 117-135 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

N78-22604# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
A FINITE ELEMENT TECHNIQUE FOR CALCULATING INDUCED INTERNAL FIELDS AND POWER DEPOSITION IN BIOLOGICAL MEDIA OF COMPLEX IRREGULAR GEOMETRY EXPOSED TO PLANE WAVE ELECTROMAGNETIC RADIATION
Stanley M. Neuder *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 170-190 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

N78-22605# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.
COMPARISON OF CALCULATED ABSORBED DOSE RATE DISTRIBUTIONS IN PHANTOM HEADS EXPOSED TO 2450 MHz AND 915 MHz PLANE WAVE AND SLOT SOURCES
Henry S. Ho *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 191-200 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

N78-22606# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
NEW TYPES OF MICROWAVE DIATHERMY APPLICATORS: COMPARISON OF PERFORMANCE WITH CONVENTIONAL TYPES
G. Kantor *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 230-249 refs (For availability see N78-22591 13-51)
(Grant FD-00790-0)
Avail: NTIS MF A01; SOD HC

N78-22612# California Univ., Los Angeles. Environmental Neurobiology Lab.
CALCIUM BINDING IN CEREBRAL TISSUE
Suzanne M. Bawain and W. Ross Adey *In* Bur. Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 305-313 refs (For availability see N78-22591 13-51)
(Contracts N00014-69-A-0200-4037; F44620-75-C-0030; Grant FD-678)
Avail: NTIS MF A01; SOD HC

N78-22613# Texas Univ. Health Science Center, Dallas. Dept. of Physiology.
VESTIBULO-COCHLEAR SINGLE UNIT RESPONSES TO MICROWAVE RADIATION
Robert M. Lebovitz and Ronald L. Seaman *In* Bur. Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 314-333 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

N78-22614# National Academy of Sciences - National Research Council, Washington, D. C. Medical Follow-up Agency.
CAUSES OF DEATH FOLLOWING OCCUPATIONAL EXPOSURE TO MICROWAVE RADIATION (RADAR) 1950 - 1974
C. Dennis Robinette and Charlotte Silverman (Bur. of Radiol. Health, Rockville, Md.) *In* Bur. Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 338-344 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

N78-22616# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.
ARE MICROWAVE CATARACTS THERMALLY CAUSED?
R. L. Carpenter, G. J. Hagan, and G. L. Donovan *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 352-379 refs Sponsored in part by Naval Med. Res. and Develop. Command (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

N78-22620* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUMMARY OF PAST FINDINGS IN BIOMEDICAL RESEARCH ACCUMULATED DURING APOLLO AND SKYLAB MISSIONS
R. S. Johnston and L. F. Dietlein *In* ESA Life-Sci. Res. in Space Sep. 1977 p 7-27 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01 CSCL 06B

N78-22624 Rome Univ. (Italy). School of Aerospace Medicine.
THREE-DIMENSIONAL BALLISTOCARDIOGRAPHY IN WEIGHTLESSNESS
Aristide Scano *In* ESA Life-Sci. Res. in Space Sep. 1977 p 51-57 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22625 Centre de Recherches de Medecine Aeronautique, Paris (France). Ecole d'Application.
ELECTRICAL IMPEDANCE AND MECHANOGRAPHY, METHODS OF CARDIO-VASCULAR INVESTIGATION IN SPACE
J. Colin and R. Carre *In* ESA Life-Sci. Res. in Space Sep. 1977 p 59-67 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22626 Centre Hospitalier Universitaire Rangueil, Toulouse (France). Dept. of Neurology.
CEREBRAL CIRCULATION IN WEIGHTLESSNESS: COMPARISON AND VALIDATION OF DIFFERENT METHODS
A. Bes, L. Braak, A. Guell, P. Jauzac, G. Geraud, and A. Blasco *In* ESA Life-Sci. Res. in Space Sep. 1977 p 69-73 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22627 Freie Univ., Berlin (West Germany). Inst. fuer Physiologie.
THE MEASUREMENT OF TISSUE THICKNESS AND TISSUE COMPLIANCE IN MAN
K. Kirsch, M. Barnkow, and W. Hepp (Dornier System G.m.b.H.) *In* ESA Life-Sci. Res. in Space Sep. 1977 p 75-79 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22628 Freie Univ., Berlin (West Germany). Inst. fuer Physiologie.
CARDIO-RESPIRATORY ADAPTATION AND CENTRAL BLOOD VOLUME DURING WEIGHTLESSNESS
G. Koch *In* ESA Life-Sci. Res. in Space Sep. 1977 p 81-85 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22629 Deutsche Sporthochschule, Cologne (West Germany). Inst. fuer Physiologie.
CIRCULATORY, RENAL AND ENDOCRINE REACTIONS ON SIMULATED WEIGHTLESSNESS DEPENDENT ON PHYSICAL FITNESS STATE
J. Stegemann and W. Skipka *In* ESA Life-Sci. Res. in Space Sep. 1977 p 87-92 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22630 Clinical Research Centre, London (England).
PERSONAL INSTRUMENTATION FOR THE REGISTRATION OF CARDIOVASCULAR AND ELECTROPHYSIOLOGICAL SIGNALS
H. S. Wolff *In* ESA Life-Sci. Res. in Space Sep. 1977 p 93 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22631 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
POSSIBLE MECHANISMS OF MOTION AND SPACE SICKNESS
A. J. Benson *In* ESA Life-Sci. Res. in Space Sep. 1977 p 101-108 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22632 Neurologische Universitaetsklinik, Freiburg im Breisgau (West Germany). Abt. fuer Neurophysiologie.
OPTICALLY INDUCED SELF-MOTION PERCEPTION
Johannes Dichgans *In* ESA Life-Sci. Res. in Space Sep. 1977 p 109-112 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22633 Neurologische Klinik der Krupp Krankenanstalten, Essen (West Germany).
EXPERIMENTAL VERTIGO, ATAXIA AND MOTION SICKNESS: VISUAL-VESTIBULAR INTERACTION ON EARTH AND IN SPACE
Thomas Brandt *In* ESA Life-Sci. Res. in Space Sep. 1977 p 113-115 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22634 Centre National de la Recherche Scientifique, Paris (France). Lab. de Physiologie du Travail.
VISUAL-VESTIBULAR INTERACTION DURING LINEAR MOTION
A. Berthoz, A. Buizza (Pavia Univ.), and R. Schmid (Pavia Univ.) *In* ESA Life-Sci. Res. in Space Sep. 1978 p 117-125 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22635 Swedish Air Force, Stockholm.
VESTIBULAR TESTS DURING SPACE FLIGHT
Ulf Brandt *In* ESA Life-Sci. Res. in Space Sep. 1977 p 127-129 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22637 Glasgow Univ. (Scotland). Inst. of Physiology.
THE RELATIONSHIP OF GRAVITY TO VESTIBULAR STUDIES
T. D. M. Roberts *In* ESA Life-Sci. Res. in Space Sep. 1977 p 139-145 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22638 Karolinska Institutet, Stockholm (Sweden). Ent Dept.
THE MAMMALIAN OTOCYST IN VITRO. A MODEL SYSTEM FOR EXPERIMENTAL PATHOLOGY ON EARTH AND IN SPACE
P.-G. Lundquist, T. R. VanDeWater, J. Wersaell, and M. Anniko *In* ESA Life-Sci. Res. in Space Sep. 1977 p 147-153 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22639 Rouen Univ. (France). Lab. Neurophysiologie Sensorielle.
INFLUENCE OF GRAVITY AND WEIGHTLESSNESS ON MATURATION OF THE EQUILIBRIUM FUNCTION
A. Gribenski *In* ESA Life-Sci. Res. in Space Sep. 1977 p 155-162 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22642 Centre de Recherches de Medecine Aeronautique, Paris (France). Ecole d'Application.
VISION AND SPACEFLIGHTS
G. Perdriel *In* ESA Life-Sci. Res. in Space Sep. 1977 p 169-171 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22643 Rome Univ. (Italy). Eye Clinic.
THE CRITICAL CENTRAL RETINAL FUSION FREQUENCY (CCRFF) AS A TEST OF THE RETINAL CIRCULATORY FUNCTION AND ITS RELATION WITH ENCEPHALIC CIRCULATION
Giacomo C. Modugno *In* ESA Life-Sci. Res. in Space Sep. 1977 p 173-175 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22645 Nijmegen Univ. (Netherlands). Dept. of Biochemistry.
EFFECTS OF HARD RADIATION ON THE VISUAL PIGMENT RHODOPSIN
S. L. Bonting, P. A. A. Jansen, and F. J. M. Daemen *In* ESA Life-Sci. Res. in Space Sep. 1977 p 185-189 refs Sponsored by Roy. Neth. Acad. of Sci. (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22654 Zurich Univ. (Switzerland). Radiobiological Inst.
RADIOBIOLOGICAL EFFECTS AT LOW DOSES. THE ROLE OF SPATIAL AND TEMPORAL ENERGY DISTRIBUTION
Hedi Fritz-Niggli *In* ESA Life-Sci. Res. in Space Sep. 1977 p 257-262 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22655 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
RESULTS OF RADIOBIOLOGICAL SPACEFLIGHT EXPERIMENTS
Horst Buecker *In* ESA Life-Sci. Res. in Space Sep. 1977 p 263-270 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22664 Brussels Univ. (Belgium). Interdisciplinary Bone Biomechanics Center.
THE APPLICATION OF IN-VIVO MEASUREMENTS OF BONE STRAIN TO SPACELAB PROGRAM. PRELIMINARY RESULTS
F. Burny, M. Hinsenkamp, R. Bourgois, V. Demolder, M. Donkerwolcke, and F. Moulart *In* ESA Life-Sci. Res. in Space Sep. 1977 p 321-326 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22666 Centre de Recherches de Medecine Aeronautique, Paris (France). Lab. Central de Biologie Aeronautique.
DETERMINATION OF THE BIOMECHANICAL PARAMETERS OF MAN'S VERTEBROMUSCULAR AXIS
P. Quandieu, B. Cailler, L. Pellieux, and P. Borredon *In* ESA Life-Sci. Res. in Space Sep. 1977 p 335-341 (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22667 Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
HUMAN TOLERANCE OF REPEATED SHOCKS
G. R. Allen *In* ESA Life-Sci. Res. in Space Sep. 1977 p 343-349 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22669# Joint Publications Research Service, Arlington, Va.
CHANGES IN PERIPHERAL BLOOD OF CREW MEMBERS OF THE SALYUT-4 ORBITAL STATION
V. I. Legenkov, R. K. Kiselev, V. I. Gudim, and G. P. Moskaleva *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 1-12 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow) v. 11, no. 6, 1977 p 3-12 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

N78-22670# Joint Publications Research Service, Arlington, Va.
HUMAN ENDURANCE OF RECURRENT +G SUB z ACCELERATIONS
S. R. Kotovskaya, R. A. Vartbaronov, and M. N. Khomenko *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 13-21 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11 no. 6, 1977 p 12-19 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

N78-22673# Joint Publications Research Service, Arlington, Va.
CLINICAL ASPECTS OF CHANGES IN THE NERVOUS SYSTEM IN THE COURSE OF 49-DAY ANTIORTHOSTATIC HYPOKINESIA
T. N. Krupina and A. Ya. Tizul *In its* Space Biol. and Aerospace Med., V. 11 No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 32-38 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 26-31 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

N78-22675# Joint Publications Research Service, Arlington, Va.
EFFECT OF PHYSICAL LOADS ON SOME PARAMETERS OF LIPID AND CARBOHYDRATE METABOLISM DURING HYPOKINESIA
T. M. Lobova and A. V. Chernyy *In its* Space Biol. and Aerospace Med., V 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 45-51 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 36-40 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

N78-22681# Joint Publications Research Service, Arlington, Va.
EFFECT OF SEDUXEN ON THE COURSE OF EXPERIMENTAL HYPOKINESIA
L. V. Zorya *In its* Space Biol. and Aerospace Med., V. 11, no. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 90-97 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), V. 11, No. 6, 1977 p 68-73 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

N78-22682# Joint Publications Research Service, Arlington, Va.
EFFECTS ON THE HUMAN BODY OF COMPLEX TESTS SIMULATING FLIGHT CONDITIONS ON THE SALYUT-4 SPACECRAFT
V. P. Dzedzichek, N. Ye. Panferova, and Ye. V. Kukolevskaya *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 98-101 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 74-75 (For availability see N78-22668 13-51)
Avail: NTIS HC A07/MF A01

N78-23032*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND PERFORMANCE OF HEART ASSIST OR ARTIFICIAL HEART CONTROL SYSTEMS
John A. Webb, Jr. and Vernon D. Gebben *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 495-506 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 12B

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-22715# Royal Aircraft Establishment, Farnborough (England).
CAN ATTENTION BE DIVERTED?
R. Johansson and A. Jonsson Sep. 1977 23 p refs Transl. into ENGLISH from report FOA-2-C-2482-H5, from Research Inst. of National Defence, Stockholm, 1971 23 p
(RAE-Lib-Trans-1936; BR61785) Avail: NTIS HC A02/MF A01

If two objects of similar shape but different contrast are searched for in a cluttered environment, how much difference in contrast is needed for the object with the greater contrast to be detected first, and does detection of the first object cause delay in detecting the second object? Two experiments were carried out with the aid of a tachistoscope to answer this question. One with the objects placed in a cluttered environment and the other with the objects in a terrain background. Results indicate that it is possible with a high level of probability, to direct an observer's attention towards the desired objects. A delaying effect can be demonstrated but many other factors are capable of interfering with it. Author

N78-22716# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
DEVELOPMENT OF NEW SELECTION TESTS FOR AIR TRAFFIC CONTROLLERS
John T. Dailey and Evan W. Pickrel Dec. 1977 11 p refs (AD-A049049; FAA-AM-77-25) Avail: NTIS HC A02/MF A01 CSCL 05/9

The multiplex controller aptitude test included the traditional types of aptitude test items, in addition to the measurement of the applicant's ability to identify potential conflicts in air traffic. The test was administered experimentally to groups whose abilities approximate those of the applicant population, and results indicated it had satisfactory results. Author

N78-22592# Randomline, Inc., Huntingdon Valley, Pa.
BEHAVIORAL EFFECTS OF ELECTROMAGNETIC ENERGY
Allan H. Frey *In* Bur. of Radiol. Health Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 11-22 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

N78-22593# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.
FREE-OPERANT AVOIDANCE AND ESCAPE FROM MICROWAVE RADIATION
John C. Monahan and W. W. Henton *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 23-33 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

N78-22597# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.
INTERACTION BETWEEN MICROWAVE AND NEUROACTIVE COMPOUNDS
W. D. Galloway and Morris Waxler *In its* Symp. on Biol. Effects and Meas. of Radio Freq./Microwaves Jul. 1977 p 62-69 refs (For availability see N78-22591 13-51)
Avail: NTIS MF A01; SOD HC

N78-23041# Joint Publications Research Service, Arlington, Va.
SOVIET-CZECH SPACE MISSION, COSMONAUT TRAINING DISCUSSED
Gy. L. *In its* Transl. on Eastern Europe (JPRS-70992) 21 Apr. 1978 p 1-4 Transl. into ENGLISH from Magy. Nemzet (Budapest), 11 Mar. 1978 p 3 (For availability see N78-23040 13-99)
Avail: NTIS HC A04/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-22717 Wayne State Univ., Detroit, Mich.
THE EFFECT OF ENERGY ABSORBING DEVICES ON SPINAL LOADS RESULTING FROM MINUS G(X) ACCELERATION Ph.D. Thesis
Paul Charles Begeman 1977 343 p
Avail: Univ. Microfilms Order No. 78-05158

The biodynamic response of cadaver torsos subjected to -Gx impact acceleration were studied with particular emphasis on the response of the vertebral column, and the reduction of forces and accelerations on the torso using energy absorbing devices. Strain measurements were made on several lumbar and thoracic vertebral bodies and the pelvis. Their magnitude and time of occurrence of peaks under restraint conditions of military harness, cross chest harness, no shoulder belt, and no head were used to infer biodynamic response and the mechanism of axial spinal loads leading to spinal injury. Spinal curvature as well as the restraint system are important in the generation of this force. Mathematical model results and high speed film analysis were used to confirm this motion. Dissert. Abstr.

N78-22718*# Massachusetts Inst. of Tech., Cambridge.
POTENTIAL USE OF NUTRITIONAL FACTORS TO OPTIMIZE PERFORMANCE UNDER STRESS Final Report, 1 Dec. 1976 - 30 Nov. 1977
H. N. Munro Nov. 1977 74 p refs
(Contract NAS9-15194)
(NASA-CR-151676) Avail: NTIS HC A04/MF A01 CSCL 06S

A study of the effects of amino acids on hypothalamo-pituitary capacity to secrete ACTH, and the response of the adrenal gland in terms of corticosterone level in the plasma was discussed in the first part of this report. Second, the report includes a study of the response of protein metabolism in various levels of corticosterone elevation in the plasma. This second part is regarded as having considerable significance for space travel, since this data indicate a threshold level of plasma corticosteroids above which there is increased catabolism of muscle protein.
Dissert. Abstr.

N78-22719*# Umpqua Research Co., Myrtle Creek, Ore.
WATER SYSTEM MICROBIAL CHECK VALVE DEVELOPMENT Interim Report
Gerald V. Colombo, Dale R. Greenley, and David F. Putnam Feb. 1978 77 p
(Contract NAS9-15079)
(NASA-CR-151678; URC-80208) Avail: NTIS HC A05/MF A01 CSCL 06K

Development work on a device for the Space Shuttle that will prevent the transfer of viable microorganisms within water systems is described. The device serves as a check valve in that it prevents the transfer or cross-contamination of microorganisms from a nonpotable system into a potable water system when these systems are interconnected. In this regard, the function of the device is similar to that of the air gap found in conventional one gravity systems. The device is essentially a bed of resin material impregnated with iodine. Basic design data for a variety of flow and temperature conditions are presented, together with results of challenging the beds with suspensions of seven microorganisms including aerobes, anaerobes, and spore formers. Author

N78-22720*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SWEAT COLLECTION CAPSULE Patent Application
John E. Greenleaf and Robert W. Delaplaine, inventors (to NASA) Filed 19 Apr. 1978 10 p
(NASA-Case-ARC-11031-1; US-Patent-Appl-SN-897828) Avail: NTIS HC A02/MF A01 CSCL 06B

A sweat collection capsule permitting quantitative collection of sweat is described. The capsule was comprised of a frame held immobile on the skin, a closure secured to the frame and absorbent material located next to the skin in a cavity formed by the frame and the closure. The absorbent materials was removed from the device by removing the closure from the frame while the frame was held immobile on the skin. NASA

N78-22721*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A PROSTHESIS COUPLING Patent Application
Vert Mooney (Rancho Los Amigos Hospital Rehabilitation Center, Downey, Calif.), James B. Reswick (Rancho Los Amigos Hospital Rehabilitation Center, Downey, Calif.), Charles W. Bright, and Lester J. Owens, inventors (to NASA) Filed 9 Feb. 1978 11 p
(NASA-Case-KSC-11069-1; US-Patent-Appl-SN-876438) Avail: NTIS HC A02/MF A01 CSCL 06B

A coupling for use in apparatus for connecting a prosthesis to a bone of a stump of an amputated limb is presented. The apparatus includes a tubular female socket having an open lower end adapted to be inserted within the intermedullary cavity of the bone. A biocompatible sleeve provides an interface between the female socket and the skin directly below the opening in the socket. A lock pin is carried by the prosthesis and has a stem portion adapted to be coaxially disposed and slideably within the tubular female socket for securing the prosthesis to the stump. The coupling is constructed of resilient material with one end thereof being attached to the socket and the other end thereof being attached by any suitable material to the biocompatible sleeve. NASA

N78-22722# Chamber of Mines, Johannesburg (South Africa).
DEVELOPMENT AND EVALUATION OF HEAT TRANSFER EQUATIONS FOR A MODEL OF CLOTHED MAN
J. M. Stewart and R. F. Goldman (Military Ergonomics Lab., Natick, Mass.) 1977 18 p refs Presented at the Intern. Conf. on Bioengineering, Cape Town, Apr. 1977
Avail: NTIS HC A02/MF A01

Two equations were derived for heat transfer from a cylinder with a wet surface and wrapped with a layer having uniform properties. Both equations represented the steady state data which were obtained from studies on a clothed, heated manikin with either a wet or dry skin. Skin wetness increased the conductance of sensible heat by 32%. Author

N78-22723*# Life Systems, Inc., Cleveland, Ohio.
TECHNOLOGY ADVANCEMENT OF THE ELECTROCHEMICAL CO2 CONCENTRATING PROCESS Annual Report
F. H. Schubert, R. R. Woods, T. M. Hallick, and D. B. Heppner Mar. 1978 75 p refs
(Contract NAS2-8666)
(NASA-CR-152098; LSI-ER-258-11) Avail: NTIS HC A04/MF A01 CSCL 06K

The overall objectives of the present program are to: (1) improve the performance of the electrochemical CO2 removal technique by increasing CO2 removal efficiencies at pCO2 levels below 400 Pa, increasing cell power output and broadening the tolerance of electrochemical cells for operation over wide ranges of cabin relative humidity; (2) design, fabricate, and assemble development hardware to continue the evolution of the electrochemical concentrating technique from the existing level to an advanced level able to efficiently meet the CO2 removal needs of a spacecraft air revitalization system (ARS); (3) develop and incorporate into the EDC the components and concepts that allow for the efficient integration of the electrochemical technique with other subsystems to form a spacecraft ARS; (4) combine ARS functions to enable the elimination of subsystem components and interfaces; and (5) demonstrate the integration concepts through actual operation of a functionally integrated ARS.

Author

N78-22724# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

A COMPARISON OF INTER-SYSTEM CONTRAST RATIOS FOR SEGMENTED DIGITAL READOUTS Final Report, Sep. 1975 - Jun. 1976

Jane M. Kline Dec. 1977 45 p refs

(AD-A050630; ASD-TR-77-64) Avail: NTIS HC A03/MF A01 CSCL 14/2

Twelve subjects viewed a Chicago Miniature segmented digital readout display to compare symbol legibility under two inter-symbol contrast ratio conditions - 4:1 and 2:1. Using two test lamps designated A and B, a series of test trials was presented under both conditions randomly intensifying the three horizontal segments of symbol A to determine the effect, if any, on symbol legibility. The stimuli consisted of numerical digits; digits 3, 5, and 9 were presented at symbol A and digits 0-9 at symbol B. Performance data were based on subject's digital readout error scores. From evaluation of the performance data, it was concluded that the 4:1 inter-symbol contrast ratio was significantly better than the 2:1 condition and that there was no apparent 'aural effect' degrading performance under either condition. Additionally, 'five' was significantly misidentified more often--primarily as a 'nine'. This identification error was attributed to insufficient distinguishing cues between the two digits. Author (GRA)

N78-22725# Army Research Inst. of Environmental Medicine, Natick, Mass.

UNDERCLOTHING AND ITS PHYSIOLOGICAL EFFECTS IN A HOT-DRY ENVIRONMENT

Fred R. Winsmann, Roger G. Soule, and Ralph F. Goldman Jan. 1977 20 p refs

(DA Proj. 3E7-62777-AB-45)

(AD-A050540; USARIEM-M-6177) Avail: NTIS HC A02/MF A01 CSCL 06/17

When underclothing of any type is worn, data collected using a static, copper manikin clearly indicate a slightly increased insulation and decreased evaporative transfer. In order to assess air movement in the dynamic state ('pumping'), the present study involved 8 men (21.2 yr., 175.2 cm and 69.1 kg) to evaluate 4 underclothing systems worn under a desert uniform: (1) no underwear; (2) std boxer shorts and t-shirt; (3) fish net 'Brynje'; and (4) ladder net 'Brynje'. The physiological trial was designed using the copper man data to select an environment and work combination which would maximize the physiologic differences expected. Accordingly, each subject walked at 4.8 km/hr with each system (40 min walk, 20 min rest and 40 min walk) at 49 C, 20% R.H. Test results show that: (1) No underwear resulted in significantly cooler mean weighted skin temperature at minutes 60, 80, and 100; (2) Rectal temperature was slightly lower at a given time interval with no underwear; (3) There was a rise in heart rate during the work periods, but no differences among underwear systems; (4) Sweat production showed no differences; and (5) The ratio of evaporated/produced sweat showed that no underwear allowed better evaporative cooling than any of the other systems. Neither fish- nor ladder-net underwear appear to offer any advantage over regular underwear; subjective comfort ratings support these conclusions. GRA

N78-22665 Max-Planck-Institut fuer Landarbeit und Landtechnik, Bad Kreuznach (West Germany).

HUMAN RESPONSE TO VIBRATION UNDER DIFFERENT CONDITIONS

H. Dupuis *In* ESA Life-Sci. Res. in Space Sep. 1977 p 327-333 refs (For availability see N78-22619 13-51)

Avail: NTIS HC A16/MF A01

N78-22679# Joint Publications Research Service, Arlington, Va.

HYGIENIC APPRAISAL OF WATER REGENERATED FROM DIVERSE FLUID-CONTAINING WASTE

Z. P. Pak, Yu. S. Koloskova, and S. V. Chizhov *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 75-82 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 57-63 (For availability see N78-22668 13-51)

Avail: NTIS HC A07/MF A01

N78-22680# Joint Publications Research Service, Arlington, Va.

VARIANTS OF CONTROL FOR AN ECOSYSTEM THAT IS CLOSED WITH REGARD TO EXCHANGE OF GASES, WITH PERIODICALLY FUNCTIONING AUTOTROPHIC COMPONENT

V. G. Shabelnikov *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 83-89 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 63-68 (For availability see N78-22668 13-51)

Avail: NTIS HC A07/MF A01

N78-22686# Joint Publications Research Service, Arlington, Va.

SANITARY AND HYGIENIC EVALUATION OF WATER REGENERATED FROM URINE

N. I. Omelyanets, L. I. Artemenko, L. P. Vlasova, N. V. Martyshchenko, and S. I. Nozdrachev *In its* Space Biol. and Aerospace Med., V. 11, No. 6, 1977 (JPRS-70633) 14 Feb. 1978 p 113-117 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 11, no. 6, 1977 p 82-84 (For availability see N78-22668 13-51)

Avail: NTIS HC A07/MF A01

N78-22732# Joint Publications Research Service, Arlington, Va.

IMAGE OF FLIGHT ARTICLE DISCUSSED

P. Bazanov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 44-50 Transl. into ENGLISH from Aviat. Kosmonaut. (USSR), no. 12, 1977 p 6-9 (For availability see N78-22726 13-59)

Avail: NTIS HC A05/MF A01

N78-23022*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

SOME MODERN CONTROL TECHNIQUES FOR HUMAN OPERATOR MODELING AND IDENTIFICATION

Richard S. Shirley *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 261-298 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 05H

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N78-22734# Joint Publications Research Service, Arlington, Va.

SEARCH FOR LIFE ON MARS

S. A. Nikitin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., no. 29 (JPRS-70659) 21 Feb. 1978 p 65-75 Transl. into ENGLISH from Priroda (USSR), no. 10, Dec. 1977 p 118-125 (For availability see N78-22726 13-59)

Avail: NTIS HC A05/MF A01

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N78-22726# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 29
21 Feb. 1978 86 p refs Transl. into ENGLISH from various Russian articles and papers, 1977 86 p
(JPRS-70659) Avail: NTIS HC A05/MF A01

Soviet and East European advances in computer systems design and adaptive control are reported, as well as the development of a laser satellite range finder for geodetic investigations. Viking spacecraft instruments and experiments for biological investigations are described. For individual titles, see N78-22727 through N78-22735.

N78-22727# Joint Publications Research Service, Arlington, Va.
SM-SERIES CONTROL COMPUTER REAL TIME OPERATIONAL SYSTEMS DESCRIBED c62
B. I. Rostokin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 5-8 Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 12, 1977 p 1-2 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

The use of real time operating systems in the design of control systems permits concentrated efforts solving problems related to developing application programs within the scope of the operating system chosen, and not problems of controlling the computer's resources. The software of small computers (SM) includes several real time operating systems which satisfy the most typical functional requirements of application areas. A family of multiprogram operational real time systems is described in which standard principles of designing hierarchial key components are used. The functional requirements are discussed for a large multiprogram disk type system having facilities for controlling complicated dynamic processes; and a system for developing relatively stable processes; and a small executive system residing in the main memory and used for special purpose applications.
A.R.H.

N78-22728# Joint Publications Research Service, Arlington, Va.
SM-SERIES-COMPUTER BASED INFORMATION GATHERING, TRANSMISSION SYSTEMS DISCUSSED c60
V. V. Grevtsev, V. A. Zimin, E. V. Keshek, and S. S. Partsevskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 9-17 Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 12, 1977 p 2-5 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

The data transmission equipment of a small-computer system (SM computers) contains all the basic modules present in large-computer remote processing systems: data transmission multiplexors, data transmission equipment, modems, signal conversion equipment, concentrators, and automatic call equipment; as well as a number of modules specially oriented toward use in SM computers, such as data transmission adapters, automatic cell adapters, programmable equipment for protection from error, simplified modems, UPS's with bipulse coding (UPS-BI's), and modems with highly simple certainty enhancement. Use of these special modules makes it possible to achieve a substantial reduction in cost of operations relating to transmission of data, especially in the low-level unit of hierarchical automated control system.
Author

N78-22729# Joint Publications Research Service, Arlington, Va.
SM-SERIES-COMPUTER BASED MEASURING-INFORMATION SYSTEM DESIGN DISCUSSED c60
Ye. A. Dubovik, G. A. Yegorvov, and V. A. Zimin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 18-23 refs Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 12, 1977 p 5-6 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

Multichannel measuring and information and control systems, implemented on the basis of SM-series computers with advanced peripherals and system links, offer the user the capability of solving a wide range of measuring and information problems and also conductive to simplicity in modernizing the entire system when changing its functional problems, which is explained by the following properties of these systems: advanced computer hardware architecture and the presence of the necessary computing resources; extensive channel-to-channel adapter, and multiplexor nomenclature. A sufficient number of different real time operational systems (as part of the standard software) make it possible to realize efficiently the required multiprogram operating modes of multichannel systems.
Author

N78-22730# Joint Publications Research Service, Arlington, Va.
HIGHER CONTROL SYSTEM SAVINGS VIA CENTRALIZATION OF COMPUTER FACILITIES URGED c63
N. M. Akhmadeyeva, T. M. Bodyanskaya, and V. M. Simchera *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 27-35 refs Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 8, 1977 p 7-10 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

The impact of computer use on Soviet technology and the economy is reviewed. A state network of computer centers and an all-state data transmission network system is proposed as the solution to the problem of automating control in the country. The components of the system are multi-use interacting networks, programming centers, data banks, message switching centers, and user centers. An algorithm is given for determining the direct savings from using such centers. Indirect savings are also discussed.
A.R.H.

N78-22731# Joint Publications Research Service, Arlington, Va.
GDR COMPUTER HARDWARE AT 1977 LEIPZIG SPRING FAIR DESCRIBED c60
N. N. Kuznetsova *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1977 p 36-43 Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 8, 1977 p 58-60 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

The Robotron and Zentronik products displayed by the German Democratic Republic include the YeS computer the YeS 7602 microfilm output unit, the Robotron K1510 microcomputer system consisting of thirty modules, the RVT 4000 programmable terminal with display, the Daro 1750 automatic bookkeeping unit, and the Daro 1375 optical scanner. The capabilities of each is described.
A.R.H.

N78-22732# Joint Publications Research Service, Arlington, Va.
IMAGE OF FLIGHT ARTICLE DISCUSSED c54
P. Bazanov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 44-50 Transl. into ENGLISH from Aviat. Kosmonaut. (USSR), no. 12, 1977 p 6-9 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

Opinions expressed by a group of pilots on how one orients oneself in space particularly when flying on instruments without seeing the ground or the natural horizon are discussed. Aspects of spatial orientation perception are reviewed and the detrimental effects of w switching from one type of display to another are examined. During automatic control, the image of flight becomes the primary means of controlling and correlating incoming information to assess the operational accuracy of the control and to forecast future developments.
A.R.H.

N78-22733# Joint Publications Research Service, Arlington, Va.
SPECIFICATIONS OF NEW ELECTRONIC INSTRUMENTS, INTEGRATED CIRCUITS AND SOLID STATE DEVICES c33

In its Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 56-64 Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 12, Dec. 1977 p 31-34 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

An equipment set for the automation of alignment operations is described which consists of a test unit for checking digital devices, a display and tester for checking the level of logic IC's, and a unit for testing transistors and resistive components mounted on circuit boards. Author

N78-22734# Joint Publications Research Service, Arlington, Va.
SEARCH FOR LIFE ON MARS c55
S. A. Nikitin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 65-75 Transl. into ENGLISH from Priroda (USSR), no. 10, Dec. 1977 p 118-125 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

Data obtained before the Viking flights indicate that in the past the planet could have had an adequate amount of liquid water and a sufficiently dense atmosphere in order to insure life. Measurements of the Martian atmosphere and surface composition by Viking-1 and Viking-2 are discussed, as well as the design of experiments conducted to determine the planet's capability to support life. A.R.H.

N78-22735# Joint Publications Research Service, Arlington, Va.
INTERKOSMOS LASER SATELLITE RANGEFINDER c36
V. A. Yegorov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 76-77 Transl. into ENGLISH from Priroda (USSR), no. 10, 1977 p 143 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

A laser satellite rangefinder, with the capability of measuring distances up to 3,000 km with an accuracy to plus or minus 5 m was developed. The instrument includes: a pointing mechanism, photoelectric detector, time interval counter and a standard time service system. Five copies of this instrument have already been fabricated and are now operating at the artificial earth satellite stations in Poland, Egypt, Bolivia, India, and Cuba. The laser satellite rangefinders make it possible to reasure the earth's diameter in a direction from north to south as well as the equatorial diameter. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N78-22736 Houston Univ., Tex.
COMPUTER APPLICATIONS TO ENGINEERING DESIGN AND DRAWINGS WITH BASIS FOR COURSE CONTENT IN TEACHING COMPUTER GRAPHICS Ph.D. Thesis
Charles Theodore Edwards, Jr. 1977 169 p
Avail: Univ. Microfilms Order No. 75-00538

The purpose of this study was to ascertain how computer graphics systems are utilized to achieve engineering design and drawings in a selected group of companies with engineering departments and the training requirements of computer graphics personnel. A secondary purpose was to determine the hardware and software recommendations for training computer graphics personnel from a selected group of manufacturers of computer graphics. Dissert. Abstr.

N78-22737 Cornell Univ., Ithaca, N. Y.
OPTIMAL DESIGN OF A GENERALIZED FILE ORGANIZATION Ph.D. Thesis
Ricardo Alberto Duhne-Aguayo 1977 176 p
Avail: Univ. Microfilms Order No. 78-01651

A semiautomatic approach to file organization design which is based upon a parametric model of alternative data storage structures. A parametric model of a generalized file organization, was modified and enhanced to consider design problems which involve multiple users. A major contribution of this dissertation is the development of (1) a parametric based cost equation with which to evaluate a given alternative and (2) a branch and bound optimization algorithm which is capable of rapidly searching the large space of alternative designs. Dissert. Abstr.

N78-22738 Massachusetts Univ., Amherst.
SCHEDULING IN MULTIPLE-PROCESSOR SYSTEMS WITH THE AID OF STOCHASTIC AUTOMATA Ph.D. Thesis
Fernando C. ColonOsorio 1977 186 p
Avail: Univ. Microfilms Order No. 7800565

Four learning stochastic automata models were considered as possible models for task schedulers in a distributed multiple processor system. A uniform treatment of all four classes if automata was presented in terms of random walks and Markov chain theory, and their performance was evaluated when operating in a nonstationary switching environment in terms of: (1) the amount of learning associated with the learned state; and (2) mean first passage time through the preferred state. The latter is defined in this work as a good measure of the model's ability to adapt to a changing environment. Queueing theory was used to establish a tight lower bound on the performance of the L sub R-P automation when serving as a model for the task schedulers in a multiple processor system. Dissert. Abstr.

N78-22739 Illinois Univ., Urbana-Champaign.
A COMPUTER HARDWARE DESIGN LANGUAGE FOR MULTIPROCESSOR SYSTEMS Ph.D. Thesis
Trevor Nigel Mudge 1977 142 p
Avail: Univ. Microfilms Order No. 7804093

A computer hardware design language that has sufficient scope to describe multiprocessing systems, and is specified so that syntactically correct programs describe systems which have deadlock-free control structures was developed. This was accomplished without resorting to an unduly complex syntax for the language. The control problem associated with multiprocessing was quite complex, and the opportunities for creating a control structure which can hang-up were great. Specifying the computer hardware design language so that this pitfall can be avoided by staying within the bounds of the syntax, gives the user a true design tool which is more that just an aid for documenting the principles of operation of a system. Dissert. Abstr.

N78-22740 Purdue Univ., Lafayette, Ind.
INFERENCE FROM STATISTICAL DATA BASES Ph.D. Thesis
Mayer Dlugach Schwartz 1977 104 p
Avail: Univ. Microfilms Order No. 78-03280

The inference problem is the most difficult in a three level hierarchy of security problems. A simple abstract model of a data base is defined in which query functions operate on confidential data items. Compromise means inference of unknown confidential items. The objective was to prove whether or not particular data base types are secure, and if they are not, how much work is required to compromise them. Dissert. Abstr.

N78-22741 Illinois Univ., Urbana-Champaign.
ANALYSIS OF MEMORY ADDRESSING ARCHITECTURE Ph.D. Thesis
Daniel Wayne Hammerstrom 1977 144 p
Avail: Univ. Microfilms Order No. 78-04014

The approach taken here is to separate program execution into a computation process and an addressing process. The addressing process generates the memory reference stream for the computation process. The memory reference stream of the computation process is then modeled probabilistically and its information content derived. It was shown that the addressing overhead, A, is lower bounded by the information content, H, of the computation process memory reference stream. Techniques were also presented for estimating A and H from traced program execution. The estimation results indicate that A estimate was much greater than H estimate indicating that not only does the addressing process place a great load on the system, but that much of that load is unnecessary. Dissert. Abstr.

N78-22742 Purdue Univ., Lafayette, Ind.
COMPUTER GRAPHICS AIDED INTERPRETIVE STRUCTURAL MODELING: A TOOL FOR CONCEPTUALIZING COMPLEX DESIGN PROBLEMS Ph.D. Thesis
Fred Edward Langhorst 1977 147 p
Avail: Univ. Microfilms Order No. 78-03251

A review of design was conducted encompassing its evolution into a science, the need for new methods and a survey of contemporary methods. Also, a study of human cognitive capacities was conducted to identify the nature of the assistance required by designers. It was shown that in design the complete definition of problem context represents a level of complexity often beyond the cognitive capacity of an individual. The conclusion reached as a result of these studies of design and of human cognitive capacities was that the class of design aides referred to as structural modeling techniques has significant potential for assisting individuals and groups in the conceptualization of complex design problems. Dissert. Abstr.

N78-22743 Ohio State Univ., Columbus.
THE DESIGN AND PERFORMANCE OF A DATABASE COMPUTER Ph.D. Thesis
Krishnamurthi Kannan 1977 308 p
Avail: Univ. Microfilms Order No. 7805863

A data model which can support existing high level data models and which can be implemented directly in hardware was proposed. The model includes a powerful query language, a flexible security policy specification and enforcement mechanism, and a data clustering mechanism for performance enhancement. The detailed design of a data base computer (DBC) which supports the data model was carried out using emerging and current technologies. The DBC was organized into two pipelines of specialized processors and memory systems. These two pipelines are known as the structure loop and the data loop. The two loops were designed to operate in a highly concurrent fashion. Dissert. Abstr.

N78-22744 California Univ., Santa Barbara.
A SELF-TUNING MICROPROGRAMMED COMPUTER Ph.D. Thesis
Khaled Ahmad El-Ayat 1977 251 p
Avail: Univ. Microfilms Order No. 7807006

The tuning methodologies and algorithms developed in this research were implemented on a 16 bit microprogrammed computer, MAC16, specially designed and built for this purpose, and were thoroughly tested by extensive experimentation. Initially, a great number of tracing experiments were conducted and their results thoroughly analyzed, to define a strategy for attacking the remaining major tasks in the tuning process. The main tuning algorithms, Analysis and Synthesis, were then designed, implemented on MAC16, and tested by many tuning examples. The difficulties and limitations encountered with the developed technique, are then reported, with suggested solutions and possible improvements. Special consideration is given to the architectural features that influence the tuning process, and the computational requirements (overhead) of the self-tuning algorithms. Dissert. Abstr.

N78-22745 Utah Univ., Salt Lake City.
AN APPLICATION OF DYNAMIC ADDRESS COMPUTATION IN DATA MANAGEMENT Ph.D. Thesis
Thomas James Cook 1977 257 p
Avail: Univ. Microfilms Order No. 7805789

An implementation technique called data-based computing which allows one to store and access data without the use of machine addresses was examined. The fundamental aspect of data-based computing is the use of data descriptions to dynamically derive address information for a given datum. The use of the data based implementation technique in the storing and access of data, in data manipulation and management functions (such as directories over collections of information), and in the organization of high-level data models (such as data base specifications and programming languages) was examined. The anticipated advantages of the data-based methods include a high degree of data independence, small space requirements, and suitability to a wide variety of data organization applications. Dissert. Abstr.

N78-22746 Arizona State Univ., Tempe.
DESIGN OF A MICROPROGRAMMABLE MICROCOMPUTER AS A DIGITAL-ANALOG SIMULATOR USING BIPOLAR/LSI PROCESSOR SLICES Ph.D. Thesis
Ahmad Sadre 1977 345 p
Avail: Univ. Microfilms Order No. 7805395

The use of microprogrammable microprocessors in developing a microcomputer system to handle an instruction set specifically designed for a block oriented simulation language is examined. A simulator program was written to simulate the complete microcomputer system. The simulator program runs on a Univac 1110 computer and it includes a cross assembler used to translate microprograms, into object code which is then stored in the control store section of the simulator. Using the simulator program it was possible to develop and debug the microprogramming for any desired set of instructions as well as to study the effects of various addressing mode in terms of exception speed and required memory space. Dissert. Abstr.

N78-22747 Ohio State Univ., Columbus.
DESIGN OF A VARIABLE HIGH LEVEL LANGUAGE COMPUTER USING PARALLEL PROCESSING Ph.D. Thesis
James Donald Mooney 1977 311 p
Avail: Univ. Microfilms Order No. 7805895

The machine uses extended hardware and fast associative storage to analyze and execute high-level code without software compiling. The actual language definition is variable; it resides in microcode and can be changed at any time. The system is planned to support most popular languages fully, without restrictions or subsetting. The system uses special purpose parallel processing units in several diverse groups. Unlike other language processors, it explores all possible parses for an input string simultaneously with independent units. A successful parse produces an execution tree which specifies actions to be performed as standard functions with sets of arguments. The execution units then evaluate these arguments, and perform the required functions in parallel. Dissert. Abstr.

N78-22748*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER-CONTROLLED INSTRUMENTATION SYSTEM FOR THIRD OCTAVE ANALYSIS
Nettie D. Faulcon and James H. Monteith Apr. 1978 38 p refs
(NASA-TM-78713) Avail: NTIS HC A03/MF A01 CSCL 09B

An instrumentation system is described which employs a minicomputer, a one-third octave band analyzer, and a time code/tape search unit for the automatic control and analysis of third-octave data. With this system the information necessary for data adjustment is formatted in such a way as to eliminate much operator interface, thereby substantially reducing the probability for error. A description of a program for the calculation of effective perceived noise level from aircraft noise data is included as an example of how this system can be used. Author

N78-22749*# Columbia Univ., New York. Dept. of Electrical Engineering and Computer Science.
MICROPROCESSOR UTILIZATION IN SEARCH AND RESCUE MISSIONS Final Report
Mischa Schwartz [1977] 47 p refs
(Contract NAS5-23727)
(NASA-CR-156746) Avail: NTIS HC A03/MF A01 CSCL 09B

The feasibility of performing the same task in real time using microprocessor technology was determined. The least square algorithm was implemented on an Intel 8080 microprocessor. Results indicated that a microprocessor could easily match the IBM implementation in accuracy and be performed inside the time limitations set. Author

N78-22750# Weapons Research Establishment, Salisbury (Australia).
A DATA MIGRATION SCHEME FOR THE 370/168 COMPUTER AT WRE
J. C. Gwatking Jun. 1977 82 p refs
(AD-A050822; WRE-TR-1870(A); AR-000-927) Avail: NTIS HC A05/MF A01 CSCL 09/2

This document describes the design and implementation of an automatic data migration system for the 370/168 computer at Weapons Research Establishment. The system simulates a volume of disk storage far greater than that actually available by maintaining an archive of infrequently used datasets on magnetic tape. These datasets can be returned to disk when required for further processing. Several supporting procedures are used in conjunction with migration to allow more effective use of real disk space and these are mentioned. Finally, some operational statistics are quoted and several enhancements proposed. Author (GRA)

N78-22751# PRC Information Sciences Co., McLean, Va.
ADVANCED COMPILATION TECHNIQUES Final Technical Report, Jul. 1976 - Sep. 1977
M. Lynn Taylor, Kathryn S. Przewlocki, and Patricia A. Watson Dec. 1977 149 p refs
(Contract F30602-76-C-0323)
(AD-A050843; RADC-TR-77-424) Avail: NTIS HC A07/MF A01 CSCL 08/2

A design specification for development of an experimental batch compilation system is presented in this report. This design specification defines the system requirements, design concepts, and software functions for the batch compilation system. The effort included analysis of compilation processes and batch processing requirements, feasibility analysis of compilation functions in a batch processing environment, and the functional design specification. Manipulation of the digital cartographic features has progressed through development of basic batch processes addressing a variety of compilation related functions. Varying capabilities exist in both the research and production environments to perform coordinate transformation, extraction, sectioning, symbolization, and other functions. Analysis was directed towards a more complete, more automatic batch compilation system. The next step towards development of advanced batch compilation functions is preparation of software development specifications for a designated computer system. GRA

N78-22752# Harry Diamond Labs., Adelphi, Md.
EXTENDING AND INTERFACING THE MSEP SEMICONDUCTOR DAMAGE DATA BANK FOR ANALYSIS AND RETRIEVAL BY DAMTRAC
Charles P. Ruzic Dec. 1977 101 p refs
(AD-A050845; HDL-TR-1821) Avail: NTIS HC A06/MF A01 CSCL 09/2

Presented are four groups of programs to update, maintain, and list the diode and transistor data bases for use with circuit analysis codes. The data bases are specifically designed to work with the DAMTRAC code, but can work with other circuit analysis codes, too. Included in the data bases are the standard TRAC parameters, references to the sources of these parameters, and damage parameters with individual source references. Author (GRA)

N78-22753# Logicon, Inc., San Diego, Calif.
TERMINAL ACCESS SYSTEM (TAS). SYSTEM DESIGN SPECIFICATION Final Report, 1 Nov. 1977 - 30 Jan. 1978
R. M. Barnhart, L. R. Erickson, M. E. Soleglad, and S. L. Westermark 30 Jan. 1978 682 p
(Contract N00014-76-C-0899)
(AD-A050967; Rept-76-C-0899-6) Avail: NTIS HC A99/MF A01 CSCL 09/2

The Terminal Access System (TAS) provides a uniform environment for computer naive intelligence analysts as they query data bases distributed on an ARPA-like network. TAS resides on a PDP-11/70 processor and operates under the UNIX Operating System. TAS performs as a user host on the network. TAS is composed of a large set of application processes which directly satisfy user entered commands involving text file editing, system status reports, and display of query responses. In addition to the TAS application processes, there is a set of system processes which provide fundamental interfaces for networking, access authorization, and network logging. These processes are designed such that other subsystems destined for TAS occupancy can utilize their facilities. The ARPA Data Access and Presentation Terminal (ADAPT) system is one such system. Key TAS system processes are the Batch Query and Response Dispatcher (BQRD) which provides internal management for all batch queries, the Intelligence Network Interface (INI) process, which emulates the COINS I protocol for TAS, the Interactive Query Interface (IQI) process, which provides system interfaces for interactive network transactions, the Access Authorization Process (AAP) which provides complete control of user/terminal access to the hosts and files residing on the COINS II network, and the TAS Logging Process (TLP) conglomerate which provides interfaces for network logging, both batch and interactive, and access authorization violations. GRA

N78-22754# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
GENERALIZATION OF HUFFMAN CODING TO MINIMIZE THE PROBABILITY OF BUFFER OVERFLOW
Pierre A. Humblet Feb. 1978 12 p refs Presented at the 1977 Intern. Symp. on Inform. Theory, Ithaca, N. Y.
(Contract N00014-75-C-1183)
(AD-A050974; ESL-P-800) Avail: NTIS HC A02/MF A01 CSCL 09/2

An algorithm is given to find a prefix condition code that minimizes the value of the moment generating function of its codeword length distribution for a given positive argument. This algorithm is used in an iterative way to yield a code that maximizes the rate of decay of the probability of buffer length increases. Author (GRA)

N78-22755# Logicon, Inc., San Diego, Calif.
ADAPT 1 FINAL FUNCTIONAL AND SYSTEM DESIGN SPECIFICATION Final Report, 1 Nov. 1977 - 30 Jan. 1978
L. R. Erickson, M. E. Soleglad, and S. L. Westermark 30 Jan. 1978 428 p
(Contract N00014-76-C-0899)
(AD-A050966; Rept-76-C-0899-2-F) Avail: NTIS HC A19/MF A01 CSCL 05/2

Under the ADAPT project, a prototype intelligent terminal will be developed which provides users and/or other systems a uniform interface for accessing multiple online databases located on different systems. The underlying technology applied by ADAPT will be the transformation from one uniform data language, UDL, to other target query languages which reside on a network. The four database systems/query languages that will be transformed are the SIGINT On-Line Information System (SOLIS), Defense Intelligence Agency On-Line System (DIAOLS)/Intelligence Support System (ISS), Data Base Management System 1100 (DMS-1100)/Query Language Processor (QLP), and Technical Information Processing Systems (TIPS)/TIPS Interrogation Language (TILE). The ADAPT system is comprised of 23 distinct UNIX processes. GRA

N78-22756# Stanford Univ., Calif. Electronics Labs.
EMMY/360 FUNCTIONAL CHARACTERISTICS
Walter A. Wallach Jun. 1976 30 p refs
(Grant DAAG29-76-G-0001)
(AD-A050577; SU-SEL-76-024; SU-DSL-TR-114; ARO-12958.10-M) Avail: NTIS HC A03/MF A01 CSCL 09/2

An emulation of the IBM System/360 architecture is presented - the EMMY/360. Problem state code which executes correctly on an IBM 360 will also execute correctly on the EMMY/360. Code producing execution exceptions will, in most cases, produce the same results on the two systems. Certain exceptions occurring on the IBM 360 cannot occur on the EMMY/360, such as address specification exceptions for main store operands, and certain precise interrupts on IBM 360 will be imprecise on the EMMY/360, such as address exceptions. The EMMY/360 supports the Standard 360 instruction set with single precision floating point. The 360 input/output structure is not supported; I/O on the EMMY system is done by Function Call instruction, rather than channel program and Start-Test I/O. Author (GRA)

N78-22728# Joint Publications Research Service, Arlington, Va.
SM-SERIES-COMPUTER BASED INFORMATION GATHERING, TRANSMISSION SYSTEMS DISCUSSED
V. V. Grevtsev, V. A. Zimin, E. V. Keshek, and S. S. Partsevskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol.,

No. 29 (JPRS-70659) 21 Feb. 1978 p 9-17 Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 12, 1977 p 2-5 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

N78-22729# Joint Publications Research Service, Arlington, Va.
SM-SERIES-COMPUTER BASED MEASURING-INFORMATION SYSTEM DESIGN DISCUSSED
Ye. A. Dubovik, G. A. Yegorvov, and V. A. Zimin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 18-23 refs Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 12, 1977 p 5-6 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

N78-22731# Joint Publications Research Service, Arlington, Va.
GDR COMPUTER HARDWARE AT 1977 LEIPZIG SPRING FAIR DESCRIBED
N. N. Kuznetsova *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1977 p 36-43 Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 8, 1977 p 58-60 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-22757 Virginia Univ., Charlottesville.
PARALLEL PROGRAMMING FOR A POLYPROCESSOR COMPUTER Ph.D. Thesis
Roger Edward Ison 1977 174 p
Avail: Univ. Microfilms Order No. 78-00440

A polyprocessor is a multiprocessor based on processors so cheap and abundant that they need not be multiprogrammed. A high level parallel programming language is presented, defining the polyprocessor as it appears to a programmer; and four extensible programs are developed. The first program introduces replication techniques, by which a population of identical, concurrent tasks can be created rapidly and without intervention of a centralized operating system. Then an algorithm is constructed to perform asynchronous parallel searches for the smallest element of a set by a recurrence method. The third program is a standard numerical application, the LU-decomposition phase of Gaussian elimination. Finally, a high performance extensible internal sorting program is presented. Dissert. Abstr.

N78-22758 Illinois Inst. of Tech., Chicago.
ALGOL 68 IMPLEMENTATION TECHNIQUES Ph.D. Thesis
Steven Joel Buroff 1977 113 p
Avail: Univ. Microfilms Order No. 7800854

The first area examined was human engineering features; the interface between the compiler and its users. The next topic of discussion was superlanguage features. Two areas of ALGOL 68, the scope restrictions, and the transient name restrictions were examined. Implementation methods were given whereby both restrictions can be removed leading to a superlanguage which is not only easier to use but also enhances expressive power. The parsing of ALGOL 68 programs was considered next. Several particular ALGOL 68 constructions which were considered difficult to parse were examined. The topic of error detection and recovery was considered. Examples of errors which were particularly hard to handle and an analysis of the reasons for the difficulty were given. Dissert. Abstr.

N78-22759 Florida State Univ., Tallahassee.
CONTRIBUTIONS TO DUALITY THEORY IN CONTINUOUS NONLINEAR PROGRAMMING Ph.D. Thesis
Thomas William Reiland 1977 126 p
Avail: Univ. Microfilms Order No. 78-01508

A dual problem is formulated and a week duality relationship is proven. A continuous time version of the well known Slater condition is used in conjunction with a continuous time Farkas Theorum to establish a Kuhn-Tucher theorem and strong duality. This method permits the verification of duality without the need for prior knowledge of the optimal solution to the primal problem. Dissert. Abstr.

N78-22760 Cornell Univ., Ithaca, N. Y.
THEORETICAL ISSUES IN THE IMPLEMENTATION OF PROGRAMMING LANGUAGES Ph.D. Thesis
Marvin Harry Solomon 1977 107 p
Avail: Univ. Microfilms Order No. 7802065

Theoretical results about two issues relevant to the implementation of programming languages are presented. The first issue concerns data types in a highly typed algorithmic language such as ALGOL 68. A model is used to show that the similarity to finite automata no longer holds if parameters may be used in the definition of types. The equivalence problem for types defined using parameters is decidable if and only if the equivalence problem for deterministic context-free sets is decidable. The definition of programming languages by means of infinite grammars is considered. It is shown that if an infinite grammar is specified by an indexed grammar, then parsing may be carried out by an algorithm analogous to the SLR(1) algorithm of DeRemer. The key to the technique involves showing that the relations and sets of items which arise, although infinite, may be represented by finite regular expressions. Dissert. Abstr.

N78-22761 Pittsburgh Univ., Pa.
DDC: A DATA FLOW MODEL OF PROGRAM EXECUTION Ph.D. Thesis
David Strauss 1977 199 p
Avail: Univ. Microfilms Order No. 78-01834

The data directed computation (DDC) model of program execution is introduced. DDC is a semantic model of programming languages suitable for implementation on parallel, asynchronous machines. It is a data flow model in that an execution is represented by a directed graph in which the nodes are subcomputations and the arcs are data links between them. A subcomputation is eligible for execution when the data upon which its results depend are available. However, unlike other data flow models, the DDC graph is a dynamic structure, whose evolution during execution is driven by the occurrence of control events. Thus, rather than being a linguistic device for expressing algorithms, it is an operational model of program semantics, reflecting the information structures that can be utilized to implement program execution in a highly parallel hardware environment. Dissert. Abstr.

N78-22762 Wisconsin Univ., Madison.
USER BASED PERFORMANCE EVALUATION OF SIMULATION LANGUAGES Ph.D. Thesis
Juzar Motiwalla 1977 205 p
Avail: Univ. Microfilms Order No. 7723723

The study focused on the methodologies and criteria for measuring ease of modelling with simulation languages for inexperienced users. Special attention was given to analysis of the impact of the world views of simulation languages on user performance. An experiment was designed to investigate the ease of modelling for novice users. Two languages with different world views and which were considered relatively easy to learn and to use were experimented upon. Problems of controlled complexity were modelled by the subjects. Problem complexity was measured by the number of independent events and processes in a problem. Ease of modelling was operationalized in terms of three dependent variables - time taken to model problems, error frequency in different error classes, and attitudes toward the language. Dissert. Abstr.

N78-22763 California Univ., Irvine.
A MODEL OF THE PROBLEM SELECTION PROCESS IN THE DESIGN OF COMPUTER PROGRAMS Ph.D. Thesis
Steven Lee Levin 1977 280 p
Avail: Univ. Microfilms Order No. 7801117

A theory of the human cognitive processes of the ways in which people select problems when they design computer programs is presented. The theory consists of three processes: information gathering, problem selection, and problem solution. In the information gathering stage, people collect facts, constraints

and strategies about the problem. During the problem selection stage, they use the available information to predict the next problem. The last process, problem solution, represents the designers' decisions for design problems. An explicit model of the problem selection process was developed by studying protocols of people designing software. The model was formulated as a computer program which reproduces the selection behavior of human designers from protocols of program design. The model uses four selection agents to describe how available information is used in the selection process. Dissert. Abstr.

N78-22764 Kansas State Univ., Manhattan.
A LANGUAGE, A PROCEDURE, AND AUTOMATED TOOLS FOR ANALYSIS OF PROBLEMS AND DESIGN OF ALGORITHMS IN A STUDENT-ORIENTED ENVIRONMENT Ph.D. Thesis
Miguel Angel Ulloa 1977 303 p
Avail: Univ. Microfilms Order No. 78-00826

The main objectives of this research was to enhance the manual tools that can be used for teaching and learning about structured programming top-down stepwise refinement, and hierarchical organization, and also to develop automated tools that can assist in this endeavor. The thesis describes a classroom-oriented high-level language and procedure for analyzing programming tasks and designing algorithms in different levels of abstraction, and it presents a set of software tools that can be used by the student to support this analysis and design. Automated tools described include a syntax and semantic analyzer, an I/O data description checker, tools for analyzing unrefined programs, and software for checking algorithm traces. Dissert. Abstr.

N78-22765 Rensselaer Polytechnic Inst., Troy, N. Y.
MULTIPLE OBJECTIVE LINEAR PROGRAMMING Ph.D. Thesis
Nancy Shoemaker Hegner 1977 195 p
Avail: Univ. Microfilms Order No. 7802855

Algorithms for solving a multiple objective linear program by finding the extreme points of the set E of efficient or nondominated solutions are described. Three modifications of such algorithms are presented. These include: (1) enabling the existing algorithms to handle degenerate feasible regions; (2) applying the algorithm to a problem of choosing a subset of E; and (3) extending the algorithm to identify maximal efficient faces. Dissert. Abstr.

N78-22766 California Univ., Los Angeles.
HIERARCHICAL ORGANIZATION OF DATA TYPES FOR PROGRAM MODULARITY Ph.D. Thesis
Carlos Helmut Lauterbach 1977 217 p
Avail: Univ. Microfilms Order No. 78-02757

The problems related to the implementation of data independence are studied. In here, abstract data are modeled as a pair formed by a hierarchy of value spaces and a set of operations with domains and ranges in this hierarchy. The concrete implementation consists of a set of representation procedures associated to each type in this hierarchy, a set of conversion mappings among these representations and a set of procedures for each abstract operation. The axioms that govern the relationship between the abstract model of the data and the concrete implementation are deduced. These axioms form the basis for the type checking mechanism and consistency checking used by a compiler. Finally, a study is made of the basic constructs needed in a programming language to form the type hierarchy, and to construct the sets of representation procedures, conversion mappings, and operations. Dissert. Abstr.

N78-22767 Wisconsin Univ., Madison.
SYNTACTIC SPECIFICATION AND ANALYSIS WITH ATTRIBUTED GRAMMARS Ph.D. Thesis
Donn Robert Milton 1977 118 p
Avail: Univ. Microfilms Order No. 7725837

Attributed grammars were investigated as an efficiently parasable syntactic specification mechanism that can handle many of the non-context-free aspects of programming language syntax. A formal definition of attributed grammars is provided, and the notion of an attributed derivation was examined. A parsable class of attributed grammars, called strong ALL(k), was identified, and the corresponding parser was developed as an extension of the strong LL(k) technique. Algorithms are presented for testing the strong ALL(k) property and for generating the strong ALL(k) parser. Finally a number of applications were considered, establishing ALL(k) grammars as an effective tool for handling context-sensitivity in programming languages, and for reducing the size of programming language grammars. Dissert. Abstr.

N78-22768 Purdue Univ., Lafayette, Ind.
A THEORETICAL STUDY OF SOME ASPECTS OF PARAMETER PASSING IN ALGOL 60 AND IN SIMILAR PROGRAMMING LANGUAGES Ph.D. Thesis
Karl Andreas Winklmann 1977 133 p
Avail: Univ. Microfilms Order No. 78-03300

In an approach similar to the study of properties of program schemes instead of programs, the notions of parameter correctness and of recursivity of procedures were defined in such a way that the intrinsic computational power of programming languages does not prevent the compile-time detection of these properties. It was then shown that nested procedure declarations together with the use of procedures as parameters have enough expressional power to still make compile-time detection of parameter errors and of recursivity impossible. Subsequently, a number of restrictions on the use of dynamic procedure declarations and on the use of procedures as parameters were given each of which makes compile-time tests for recursivity and for parameter correctness at least theoretically possible. Dissert. Abstr.

N78-22769 California Univ., Los Angeles.
MULTILEVEL MODELING FOR SYNTHESIS OF RELIABLE CONCURRENT SOFTWARE SYSTEMS Ph.D. Thesis
Ivan Moura Campos 1977 448 p
Avail: Univ. Microfilms Order No. 78-2753

A method for multilevel modeling of software suitable for the design of systems with concurrent processes is presented. The methodology is requirement-driven and uses tools for structural and behavioral modeling incorporated in a programming system called SARA (System Architect's Apprentice). Both top-down refinement and bottom-up abstraction are supported. Example designs are presented to illustrate the steps in going smoothly from programming-in-the-large to programming-in-the-small or actual code. They also illustrate the use of building block models of software systems in bottom-up composition. Dissert. Abstr.

N78-22770 Purdue Univ., Lafayette, Ind.
A MEASURE OF MENTAL EFFORT RELATED TO PROGRAM CLARITY Ph.D. Thesis
Ronald David Gordon 1977 140 p
Avail: Univ. Microfilms Order No. 78-03225

A functional relation between the clarity of a program and the number and frequency of operators and operands which occur in the program is presented. This measure of program clarity provides an estimate of the amount of mental effort required to understand the program, assuming that the reader is fluent in the programming language employed. The level of comprehension achieved after studying a program for a fixed period of time can be predicted. The removal of impurities in algorithm implementations is studied. It is found that the removal of impurities tends to reduce the estimated amount of mental effort required for program comprehension. That result provides a simple explanation of the motivation for program purification. Dissert. Abstr.

N78-22771 Ohio State Univ., Columbus.
GRAMMATICAL INFERENCE OF REGULAR AND CONTEXT-FREE LANGUAGES Ph.D. Thesis
Delores Ann Marik 1977 269 p
Avail: Univ. Microfilms Order No. 78-05881

The problem of grammatical inference for the classes of regular and context free languages was examined. Results are the grammatical inference algorithm for regular languages and the corresponding procedure for context-free languages. The model of inference used is shown to be a general model of learning, and thus contributes to artificial intelligence. The computational complexity results explain why it has been difficult to develop efficient algorithmic learning models in such diverse areas as

language learning, pattern recognition, autoprogramming, and other areas of artificial intelligence, including grammatical inference. Dissert. Abstr.

N78-22772 Auburn Univ., Ala.
A MODEL FOR ESTIMATING THE NUMBER OF RESIDUAL ERRORS IN COBOL PROGRAMS Ph.D. Thesis
Cecil E. Martin 1977 152 p
Avail: Univ. Microfilms Order No. 78-06088

Program structural characteristics metrics internal complexity is a means of estimating the number of errors. Thirteen unrelated characteristics metrics are used to define 7 local complexities which are predictors of the number of errors in COBOL programs. Linear models for each of these metrics are available for predicting software errors. Models developed from these metrics can be used to predict the number of errors in COBOL programs. The best single variable model for predicting errors is the control flow complexity metric model. The best multiple variable model for predicting errors is the one that contains all 7 local complexity metrics. The latter model can be used when dealing with many types of programs that are developed by different organizations. Dissert. Abstr.

N78-22773 Southwestern Louisiana Univ., Lafayette.
A SPECIFICATION LANGUAGE AND ITS PROCESSOR Ph.D. Thesis
Joseph Edward Urban, III 1977 190 p
Avail: Univ. Microfilms Order No. 78-06170

The design, implementation, and evaluation of a specification language is described. Descartes, the specification language presented, uses data structuring methods suggested by Hoare. These data structuring methods are sufficient to describe any data structure without the use of pointers. These methods are used in Descartes to analyze program input into constituent parts that are then used to synthesize a description of program output. An interpreter developed for Descartes specifications, so that the specifications for a program can be executed on sample data for the program. Execution is slow, but does allow the specification itself to be tested before programming begins. Specifications were developed in a top down, modular fashion. A large number of sample specifications are presented to demonstrate the usefulness of the specification language. The sample specifications illustrate features and support the evaluation of the language. Dissert. Abstr.

N78-22774 Cornell Univ., Ithaca, N. Y.
LANGUAGE FEATURES FOR PROCESS INTERACTION AND ACCESS CONTROL Ph.D. Thesis
James Russell McGraw 1977 280 p
Avail: Univ. Microfilms Order No. 7806338

High-level language facilities for representing process interaction and access control are developed and analyzed. The focus is placed on the problem of designing operating systems and was guided by two basic goals: expressability and data integrity. The analysis is primarily concerned with the relationship between language features and the deadlock and safety problems. A resource facility, a variation of the monitor concept, for defining process interaction is proposed. Also proposed are two new types of access control mechanisms: a restrict pseudo-statement permits a programmer to selectively tighten standard scope rules; a system based on the capability concept provides comparable control of dynamic access rights. Three properties of programs written in a language incorporating the features are analyzed. Dissert. Abstr.

N78-22775 Cornell Univ., Ithaca, N. Y.
ANALYZING AND IMPROVING QUASI-NEWTON METHODS FOR UNCONSTRAINED OPTIMIZATION Ph.D. Thesis
Robert B. Schnabel 1977 214 p
Avail: Univ. Microfilms Order No. 7806348

This thesis is concerned with analyzing and improving the performance of quasi-Newton methods for finding the minimum of a real valued function of a finite number of real variables. A recent algorithm of Davidon's has contributed two important new ideas to the formulation of updates, while improving upon the computational performance of existing algorithms. In this thesis the work of Davidon is analyzed and some changes to his algorithm are proposed. The two innovations in Davidon's are the use of a new update class intended to preserve past derivative information in the Hessian approximation, and the selection of the actual update from this class by a method called optimal conditioning. Both of these aspects are thoroughly explained and analyzed. Dissert. Abstr.

N78-22776 Maryland Univ., College Park.
APPROXIMATION ALGORITHMS FOR NP-HARD ROUTING PROBLEMS Ph.D. Thesis
Greg Norman Frederickson 1977 100 p
Avail: Univ. Microfilms Order No. 78-05014

The exact solution to NP hard problems appears to require in worst case an amount of time that grows explosively with the size of the problem. Therefore, approximation algorithms were developed that guarantee nonoptimum but close to optimum solutions. A measure of the performance of such algorithms is the worst case ratio of the cost of a solution generated by the algorithm to the cost of an optimum solution. Dissert. Abstr.

N78-22777*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GSFC SYSTEMS TEST AND OPERATION LANGUAGE (STOL) FUNCTIONAL REQUIREMENTS AND LANGUAGE DESCRIPTION
Richard DesJardins, Gardiner Hall, James McGuire, Phillip Merwarth, William Mocarsky, Walter Truszkowski, Anthony Villasenor, Fred Brosi (Computer Sci. Corp., Los Angeles, Calif.), Preston Burch (OAO Corp., Beltsville, Md.), and David Carey (RCA, New York) Feb. 1978 44 p Submitted for publication (Contract NAS5-24300)
(NASA-TM-79541; X-408-77-100) Avail: NTIS HC A03/MF A01 CSCL 09B

The Systems Tests and Operation Language (STOL) provides the means for user communication with payloads, applications programs, and other ground system elements. It is a systems operation language that enables an operator or user to communicate a command to a computer system. The system interprets each high level language directive from the user and performs the indicated action, such as executing a program, printing out a snapshot, or sending a payload command. This document presents the following: (1) required language features and implementation considerations; (2) basic capabilities; (3) telemetry, command, and input/output directives; (4) procedure definition and control; (5) listing, extension, and STOL nucleus capabilities. Author

N78-22778# National Aerospace Lab., Tokyo (Japan).
COMPUTER ALGORITHMS FOR COMPUTATION OF KINEMATICAL RELATIONS FOR THREE ATTITUDE ANGLE SYSTEMS
Yoshiaki Ohkami Nov. 1977 18 p refs
(NAL-TR-305T) Avail: NTIS HC A02/MF A01

Two algorithms were developed for three attitude angle systems used in digital computer simulation of attitude dynamics of spacecraft; one is for transformation of the 3x1 matrix representing a generic vector in a vector basis into the other 3x1 matrix in another vector basis, and the other is for computation of angular velocity relations between the body rates and time derivatives three attitude angles. These algorithms were derived by virtue of a general representation of the transformation matrix defined as a product of three planar rotation matrices, and properly defined elementary matrices. Based on the established algorithms, progarms were developed, in which the kinematical relations are automatically computed for an arbitrary order of planar rotations without requiring any manual calculations, provided that the order and three attitude angles are given as input. The algorithms, and the programs as well, posess inversion capability, permitting transformation from reference to body frame and vice versa. Author

N78-22779# Sacramento Air Logistics Center, McClellan AFB, Calif. Data Automation Branch.
SOFTWARE ENGINEERING PROJECT MANAGEMENT: A SURVEY CONCERNING U.S. AEROSPACE INDUSTRY MANAGEMENT OF SOFTWARE DEVELOPMENT PROJECTS Interim Report
Richard H. Thayer and John H. Lehman 1 Nov. 1977 18 p refs

(AD-A050802; SM-ALC/ACD-TR-77-02) Avail: NTIS HC A02/MF A01 CSCL 05/1

Project management is clearly a part of software engineering, and its effective employment plays a major role in reducing the problems associated with delivering software within estimated time and cost. The question this paper addresses is: 'What is the state-of-the-art in software engineering project management today'. In an attempt to provide this answer, a survey of highly qualified executive managers of major U.S. aerospace corporations was conducted. This paper reports on that survey describing how these corporations manage software development projects, discusses the major differences in methods used, and how software engineering project management might be improved.

Author (GRA)

N78-22780# Sacramento Air Logistics Center, McClellan AFB, Calif. Data Automation Branch.

SOFTWARE ENGINEERING PROJECT MANAGEMENT. A SURVEY ON THE U.S. AEROSPACE INDUSTRY'S MANAGEMENT: SOFTWARE DEVELOPMENT PROJECTS

Richard H. Thayer and John H. Lehman 1 Nov. 1977 30 p (AD-A050803; SM-ALC/ACD-TR-77-03) Avail: NTIS HC A03/MF A01 CSCL 05/1

This report contains a copy of the visual aids with accompanying narrative of a presentation given at the American Institute of Aeronautics and Astronautics (AIAA) Conference Computers in Aerospace, 31 Oct - 2 Nov 1977. This presentation was part of a session on 'Software Management - Development' and based on data gathered during a survey on how the U.S. aerospace industry manages its software engineering projects. This is Report No. 2 of a planned series of reports on the data. Report No. 1 is contained in the proceedings of the subject conference.

Author (GRA)

N78-22781# Stanford Univ., Calif. Dept. of Computer Science.

INTERFERENCE RULES FOR PROGRAM ANNOTATION

Nachum Dershowitz and Zohar Manna Oct. 1977 53 p refs (Contract MDA903-76-C-0206; Grants AF-AFOSR-76-2909; NSF MCS-76-83655)

(AD-A050806; SU-STAN-CS-77-631; AIM-303) Avail: NTIS HC A04/MF A01 CSCL 09/2

Methods are presented whereby an ALGOL-like program, given together with its specifications, may be documented automatically. This documentation expresses invariant relationships that hold between program variables at intermediate points in the program, and explains the actual workings of the program regardless of whether the program is correct. Thus this documentation can be used for proving the correctness of the program, or may serve as an aid in the debugging of an incorrect program. The annotation techniques are formulated as Hoare-like inference rules which derive invariants from the assignment statements, from the control structure of the program, or, heuristically, from suggested invariants. The application of these rules is demonstrated by two examples which have run on our implemented system. Author (GRA)

N78-22782# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.

RAYMAN: A FORTRAN COMPUTER CODE FOR TRACING RAYS THROUGH A DETAILED HUMAN PHANTOM Final Report

William B. Beverly Nov. 1977 65 p (DA Proj. 1L6-62618-AH-80)

(AD-A051057; ARBRL-TR-2030) Avail: NTIS HC A04/MF A01 CSCL 06/21

A FORTRAN computer program RAYMAN has been written that simulates an average human adult male in a hostile ballistic environment. Projectiles are picked from a user-chosen ballistic threat and those striking the phantom human are tracked to their exit from his body. Ballistic vulnerability factors, associated with the physiological detail of the phantom, are retrieved at regular intervals along the shotlines of the impacting projectiles. The retrieved vulnerability factors are averaged over many shotlines to yield a histogramic representation of the average vulnerability factor versus tissue penetration. Results are printed in tabular form along with identifying captions. Author (GRA)

N78-22783# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

RATIONALE FOR FIXED-POINT AND FLOATING-POINT COMPUTATIONAL REQUIREMENTS FOR A COMMON PROGRAMMING LANGUAGE Final Report, Jan. 1975 - Jan. 1977

David A. Fisher and Philip R. Wetherall Jan. 1978 70 p refs (Contract DAHC15-73-C-0200)

(AD-A050657; AD-E500019; IDA/HQ-77-19836; P-1305) Avail: NTIS HC A04/MF A01 CSCL 09/2

This paper discusses the considerations that led to the individual technical requirements for the numeric computation facilities for a common programming language for the Department of Defense (DoD). Of five kinds of arithmetic considered, one floating-point and one form of fixed-point including integers were found to be appropriate for the common language. The implications of the various requirements for the language designers, the compiler-writer, the user, and the machine designer are considered. Author (GRA)

N78-22784# University of Southern Calif., Marina del Rey. Information Sciences Inst.

META-EVALUATION AS A TOOL FOR PROGRAM UNDERSTANDING

Robert Balzer, Neil Goldman, and David Wile Jan. 1978 19 p refs Presented at 5th Intern. Joint Conf. on Artificial Intelligence, Aug. 1977

(Contract DAHC15-72-C-0308; ARPA Order 2223)

(AD-A050590; ISI/RR-78-69) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes the technology used in a running system that embodies theories of program well-formedness and informality resolution established by symbolically executing the program to systematically discover the intended meaning of each informal construct within an informal specification. GRA

N78-22785# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

DISTRIBUTED COMPUTATION AND TENEX-RELATED ACTIVITIES Quarterly Progress Report, 1 Aug. - 31 Oct. 1977

Richard E. Schantz and Robert H. Thomas Jan. 1978 49 p (Contracts N00014-75-C-0773; ARPA Order 2935)

(AD-A050594; BBN-3753; QPR-12) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes BBN efforts in the design of the National Software Works system and BBN efforts to integrate TENEX into the National Software Works system. Author (GRA)

N78-22786# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.

A SURVEY OF LAGRANGIAN TECHNIQUES FOR DISCRETE OPTIMIZATION

Jeremy F. Shapiro May 1977 46 p refs (Contract DAAG29-76-C-0064)

(AD-A050791; TR-133) Avail: NTIS HC A03/MF A01 CSCL 12/1

This survey covers the theory and application of Lagrangian techniques to discrete optimization problems. A discussion of the applications includes integer programming special structures which can be exploited by Lagrangian techniques, multi-item production scheduling and inventory control problems, and the traveling salesman problem. The relationship of Lagrangian techniques to duality theory and convex analysis is given including a discussion of algorithms to solve the dual problems. Duality theory for integer programming and its relationship to the cutting plane method is reviewed. The use of Lagrangian techniques in conjunction with branch and bound is presented in a general framework for solving discrete optimization problems.

Author (GRA)

N78-22787# George Washington Univ., Washington, D. C. Inst. for Management Science and Engineering.

EXACT SENSITIVITY ANALYSIS USING AUGMENTED LAGRANGIANS Interim Technical Report

Robert L. Armacost and Anthony V. Fiacco 22 Mar. 1977 38 p refs (Contract DAAG29-76-G-0150)

(AD-A050792; SERIAL-T-349) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper reviews several recently developed sensitivity analysis results for a general class of parametric nonlinear programming problems and develops formulas for calculating the sensitivity measures, i.e., the partial derivatives of a Kuhn-Tucker triple and the optimal value function, using an augmented Lagrangian. The theory, developed in the general case in terms of the ordinary Lagrangian and extended to allow the utilization of traditional penalty functions, is applied. Recently obtained results (using a different manner of proof) are shown to follow immediately using the present approach. Furthermore, the relationship of the calculations to those involving the usual Lagrangian are made explicit, hence all the results obtained previously in terms of the usual Lagrangian are immediately applicable. Author (GRA)

N78-22788# Maryland Univ., College Park. Computer Science Center.
ARRAY GRAMMARS Interim Report
Azriel Rosenfeld Jan. 1978 53 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A050794; TR-629; AFOSR-78-0353TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report is a draft of Chapter 8 of a forthcoming book on 'Picture Languages'. This chapter deals with array grammars, with emphasis on their relationship to acceptors; some preliminary material on string grammars is also included. Comments on the choice and treatment of the material are invited. GRA

N78-22789# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
A CUT APPROACH TO A CLASS OF QUADRATIC INTEGER PROGRAMMING PROBLEMS
Jean-Claude Picard and H. Donald Ratliff Jan. 1978 15 p refs
(Contract N00014-76-C-0096; Grant DAHC04-75-G-0150)
(AD-A050924; RR-78-2; ARO-12640.25-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents an efficient algorithm for solving a class of quadratic integer programming problems. These problems include discrete versions of the quadratic placement problem and the squared Euclidean distance problem. The algorithm solves a finite sequence of minimum cut problems, or equivalently maximum flow problems, on a graph with n 2 vertices where n is the number of variables in the problem. Author (GRA)

N78-22790# Georgia Inst. of Tech., Atlanta.
PROBABILISTIC REMARK ON ALGEBRAIC PROGRAM TESTING
Richard A. DeMillo and Richard J. Lipton (Yale Univ., New Haven, Conn.) May 1977 9 p refs
(Grant DAAG29-76-G-0338)
(AD-A050745; GIT-ICS-77/07) Avail: NTIS HC A02/MF A01 CSCL 09/2

A key step in Howden's method for algebraic program testing requires checking the algebraic identity of multinomials. Howden's solution requires evaluations in at least 2 to the mth power points for m-ary multinomials. This note presents a probabilistic solution which achieves small probability of error on 30 points. GRA

N78-22791# Logicon, Inc., San Diego, Calif.
ADAPT 1 UNIFORM DATA LANGUAGE (UDL): A FINAL SPECIFICATION Final Report, 1 Nov. 1977 - 30 Jan. 1978
L. R. Erickson, M. E. Soleglad, and S. L. Westermark 30 Jan. 1978 153 p
(Contract N00014-76-C-0899)
(AD-A050965; Rept-76-C-0899-1) Avail: NTIS HC A08/MF A01 CSCL 05/2

Under the adapt project, a prototype intelligent terminal will be developed which provides users and/or other systems a uniform interface for accessing multiple on line data bases located on different systems. The underlying technology applied by ADAPT will be the transformation from one uniform data language, UDL, to other target query languages which reside on a network. ADAPT will be comprised of four phases ADAPT 1 provides the fundamental ADAPT system architecture baseline for subsequent phases and also a limited user data base query and display facility for four data base management systems. ADAPT 2 will provide users a data base maintenance facility for four DBMSs, as well as data display enhancements. ADAPT 3 will produce two production models of ADAPT, one installed in network centers and the other as a stand-alone intelligent terminal. ADAPT 4 will provide a local data base manager for onsite file creation. Author (GRA)

N78-22792# National Cancer Inst., Bethesda, Md. Lab. of Theoretical Biology.
SAAM27 (SIMULATION, ANALYSIS AND MODELING). USER'S MANUAL Interim Report
Mones Berman and Marjory F. Weiss 15 Apr. 1977 195 p Supersedes NIH/DF-76/001a, PB-256468
(PB-27651/5; NIH/DF-78/001A; NIH/DF-76/001a; PB-256468) Avail: NTIS HC A09/MF A01 CSCL 09B

A digital computer program developed for the analysis of data in terms of (SAAM) models is discussed. It permits simulation and data fitting, and contains various techniques encountered in model building. Although developed primarily for biological systems and more specifically for kinetic models, the program is of general utility. It differs from other simulation and data fitting programs in that its language is geared to the bio-medical system investigator, and its elements and computational procedures are counterparts of conceptualizations and experimental methodologies employed by the investigator. SAAM is a large, complex program and is perennially being extended and revised. This manual describes the SAAM27 version of the program. GRA

N78-22793# Argonne National Lab., Ill.
SOFTWARE PACKAGE AS AN INFORMATION CENTER PRODUCT
Margaret K. Butler 1977 10 p refs Presented at the Ann. Meeting for the Am. Soc. for Inform. Sci., Chicago, 26 Sep. - 1 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-770993-1) Avail: NTIS HC A02/MF A01

The goal of the center's program is to provide a means for sharing of software among agency offices and contractors, and for transferring computing applications and technology, developed within the agencies, to the information-processing community. A major activity of the code center is the acquisition review, testing, and maintenance of a collection of software-computer systems, applications programs, subroutines, modules, and data compilations--prepared by agency offices and contractors to meet programmatic needs. A brief review of the history of computer program libraries and software sharing is presented to place the code center activity in perspective. The state-of-the-art discussion starts off with an appropriate definition of the term software package, together with descriptions of recommended package contents and the Carter's package evaluation activity. ERA

N78-22794# Sandia Labs., Albuquerque, N. Mex.
ACCURACY OF CDC 6600/7600 FORTRAN LIBRARY FUNCTIONS
Carl B. Bailey and R. E. Jones Oct. 1977 43 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1038) Avail: NTIS HC A03/MF A01

Results are presented of tests of accuracy performed on FORTRAN library functions corresponding to version 3.0 of the FORTRAN Extended Library and version V327 of the CDC 6600 SCOPE 3.3 operating system; version 4.6 of the FORTRAN Extended Library and the NOS operating system; and version 4.6 of the FORTRAN extended Library and level 221C of the 7000 SCOPE 2.1 operating system. ERA

62 COMPUTER SYSTEMS

Includes computer networks.

N78-22795 California Univ., Irvine.
A TOKEN FLOW MODEL APPLIED TO COMPUTER NETWORKS Ph.D. Thesis
Kenneth Clair Larson 1977 112 p
Avail: Univ. Microfilms Order No. 78-01912

The techniques presented are an approach to the modelling

and analysis of computer systems and networks. Emphasis is placed on the analysis of communications protocols. The approach taken is based on the graph model of computation and the vector addition system associated with flow-graph schemata, but uses new analysis techniques which are more efficient and give new practical results. The analysis techniques presented are an efficient way of analyzing a multiprocessor system or computer network for logic errors which plague system designers.
Dissert. Abstr.

N78-22796 California Inst. of Tech., Pasadena.
AN ENGINEERING FORMALIZATION OF COMPUTER SYSTEMS Ph.D. Thesis
Luis Manuel Medina-Vaillard 1978 101 p
Avail: Univ. Microfilms Order No. 7732571

The basic tools came from systems theory, mathematical logic, operating systems, and computer architecture. Two sound engineering principles were fundamental in the formal apparatus: hierarchical organization and elimination of dependent malfunctions (like race conditions in hardware and mutual exclusion in software). All the basic elements in a computer system were identified as singletons. Typical singletons were: (sequential) user programs, (concurrent) operating systems, virtual machines, and hardware machines. A computer system was just a set of interrelated singletons. Velocity and transparency were defined and used as a measure of the quality of a hierarchy. Computer systems were analyzed as directed graphs (singletons being the nodes), and directions for research in optimal structuring were suggested. Dissert. Abstr.

N78-22797 Colorado State Univ., Fort Collins.
FORECASTING COMPUTER WORKLOAD USING TIME SERIES AND CLUSTER ANALYSES Ph.D. Thesis
David Michael Kroenke 1977 135 p
Avail: Univ. Microfilms Order No. 78-02377

The prediction problem is discussed in general and an overview is provided of clustering techniques. Clustering methodology used in this dissertation is explained and cluster results are presented. ARIMA and linear regression models are discussed and results are given of application of ARIMA and linear models to the Forest Service jobs. Finally, examples of the application of these techniques to a variety of forecasting problems are shown.
Dissert. Abstr.

N78-22798 Northwestern Univ., Evanston, Ill.
AN INVESTIGATION OF THE USE OF CHECKPOINT SCHEMES IN DISTRIBUTED PROCESSING SYSTEMS Ph.D. Thesis
Mark Charles Kerstetter 1977 141 p
Avail: Univ. Microfilms Order No. 78-05290

Checkpoint/restart was applied to synthetic programs, represented by program task graphs, whose tasks were processed in parallel on elements of the distributed system. A general rather than implementation dependent view was assumed. The problems of using checkpoint/restart schemes were enumerated and expanded from single stream to multistream systems. A measure called the probability of completion was introduced. A simple analytic technique based on renewal theory is presented for a single task case. Several heuristic checkpoint/restart schemes are given and evaluated according to the measure as obtained from a simulator for distributed processing systems.
Dissert. Abstr.

N78-22799 Ohio State Univ., Columbus.
A SYSTEM FOR GENERATING THREE-DIMENSIONAL DATA FOR COMPUTER GRAPHICS Ph.D. Thesis
Richard Earl Parent 1977 213 p
Avail: Univ. Microfilms Order No. 7805904

One of the biggest bottlenecks in three dimensional computer graphics is the inputting of complex object descriptions. A software system which provides one solution to the problem is described. A sculptor's studio like environment in which the sculptor can create descriptions of complex three dimensional objects in the computer as if molding a piece of clay in the machine was created. This calls for an array of techniques to be implemented and available on call to the user: scaling, slicing, gouging, joining objects, cutting one object with another, three dimensional warping and bending. Issues involved in designing such a system are identified and discussed. The general operation of the specific system developed to solve the problem of generating three dimensional data is presented, along with the descriptions of the major algorithms which were developed for the system: intersection, warp and bend. Dissert. Abstr.

N78-22800 Ohio State Univ., Columbus.
ON THE MEASUREMENT AND ESTIMATION OF COMPUTER CENTER PERFORMANCE Ph.D. Thesis
Badie Naiem Farah 1977 191 p
Avail: Univ. Microfilms Order No. 7805836

The goal of this study was to provide a methodology for the measurement and estimation of batch mode configuration performance. The main components of this methodology are: a data collection schema to measure the performance of an existing configuration; and a model which can be used to estimate the performance of the configuration when its parameters are changed. A model which can be used to study the performance of the configuration when its parameters are changed was established. Two methods of solutions, analytic and simulation, for this model were obtained. Dissert. Abstr.

N78-22801# System Development Corp., Santa Monica, Calif.
COMPUTER SCIENCE AND TECHNOLOGY: DESIGN ALTERNATIVES FOR COMPUTER NETWORK SECURITY
Gerald D. Cole and Dennis K. Branstad Jan. 1978 177 p refs
(Contract NBS-5-35934)
(PB-276771/3; NBS-SP-500-21-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 09B

A specification for generating security mechanisms by determining the issues and tradeoffs related to network security over a broad range of network applications, topologies and communications technologies was developed. The approach which was taken was that of using a dedicated network security controller minicomputer for checking the authentication of requestors, and, to some extent, for authorization checking as well. Author

N78-22802# System Development Corp., Santa Monica, Calif.
COMPUTER SCIENCE AND TECHNOLOGY: THE NETWORK SECURITY CENTER: A SYSTEM LEVEL APPROACH TO COMPUTER NETWORK SECURITY Final Report
Frank Heinrich Jan. 1978 74 p refs
(Contract NBS-5-35934)
(PB-276772/1; NBS-SP-500-21-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 09B

A computer network resource, called a network security center (NSC), performs the functions of user identification/authentication and access request authorization and works in concert with network cryptographic devices to enforce access control policy through the creation or denial of logically separate cryptographic connection between subjects (users) and objects (resources). Implementation options for a NSC are presented, covering the areas of data structures, I/O structure, control structure, and size and performance limitations. GRA

N78-22727# Joint Publications Research Service, Arlington, Va.
SM-SERIES CONTROL COMPUTER REAL TIME OPERATIONAL SYSTEMS DESCRIBED
B. I. Rostokin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 5-8 Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 12, 1977 p 1-2 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N78-22803 Illinois Inst. of Tech., Chicago.
TRANSACTIONS ORIENTED QUEUEING SYSTEM SIMULATION ON NETWORK COMPUTERS Ph.D. Thesis

Thomas Woods Christopher 1977 125 p
Avail: Univ. Microfilms Order No. 78-00857

Three techniques are presented to estimate the minimum delay a transaction may encounter once reactivated. The three techniques are (1) The quickest path technique uses interval arithmetic to determine the delay at any WAIT instruction, associates these delays with edges in the control flow graph for the transaction's program, and uses shortest path analysis to determine minimum delay. (2) The search considering SEIZE nodes technique performs a depth first search of acyclic paths through the control flow graph considering the earliest times the transaction could seize the facilities associated with the SEIZE instructions it encounters. (3) The search with precomputed waits technique computes in advance the delays the transaction will encounter at certain WAIT instructions. Dissert. Abstr.

N78-22804 Columbia Univ., New York.
QUEUEING ANALYSIS OF A PACKET SWITCHING NODE IN A DATA COMMUNICATIONS SYSTEM Ph.D. Thesis
John Nelson Daigle 1977 289 p
Avail: Univ. Microfilms Order No. 78-02321

The queueing process at a packet switching node is modeled as a two dimensional birth and death process and transform techniques were used to solve the equilibrium state equations. In the model, message sources were assumed to be either: (1) computers, which generate multipacket messages; or (2) users, which generate packets at a Poisson rate gamma. There were a finite number of computer classes and class i has a finite number of computers K sub i. The computers operate independently, and each computer was assumed to have busy and idle periods following an alternating renewal process. During each busy period, each class i computer generates packets at a Poisson rate, beta sub i. The model thus provides a way of studying data communications systems in which finite local access line capacity, message length, packeting, the number of independent sources, and traffic mix were important factors. Dissert. Abstr.

N78-22805 Maryland Univ., College Park.
AUTOMATIC CLOUD CLASSIFICATION AND SEGMENTATION Ph.D. Thesis
Josephine Ann Parikh 1977 424 p
Avail: Univ. Microfilms Order No. 78-04502

A comparative study of statistical pattern recognition techniques demonstrated a need for application of image segmentation techniques prior to the feature extraction process. Segmentation models for identification of cloud-type objects were defined and tested on sample sets of meteorological satellite data. Significant improvement in classification accuracy was achieved by incorporating the most promising of the segmentation techniques into a statistical pattern recognition model based on cloud segment features. Dissert. Abstr.

N78-22806 Purdue Univ., Lafayette, Ind.
ERROR-CORRECTING PARSING FOR SYNTACTIC PATTERN RECOGNITION Ph.D. Thesis
Shin-Yee Lu 1977 322 p
Avail: Univ. Microfilms Order No. 78-03259

The problem of modeling, analysis and reconstruction of noisy and/or distorted syntactic patterns was studied. Segmentation errors and primitive extraction errors can be treated as syntax errors and defined in terms of language transformation rules. Three types of error transformations were defined on strings, namely substitution, insertion and deletion. Consequently, the parser constructed according to the grammar generating the strings and the three types of transformations is called the error correcting parser. This technique was also extended to tree languages.
Author

N78-22807 Purdue Univ., Lafayette, Ind.
ERROR ESTIMATION AND SEPARABILITY MEASURES IN FEATURE SELECTION FOR MULTICLASS PATTERN RECOGNITION Ph.D. Thesis
Stephen Jay Whitsitt 1977 187 p
Avail: Univ. Microfilms Order No. 78-03296

An important tool in estimating classification system performance is Monte Carlo type simulation. In cases where class density functions are known but error is difficult to compute, an estimator for error was presented which combines stratified sampling and average pointwise posterior probabilities. A reduction in variance in estimating error was demonstrated. Examples for Bayes and non-Bayes classifiers were given. Confidence intervals were developed for sample sizes. In case sets of two normal patterns were to be randomly generated, some symmetry properties were shown to reduce the region in the parameter space which must be simulated. These techniques were used to generate plots of pairwise error versus the Chernoff and Bhattacharyya bounds for normal classes. Dissert. Abstr.

N78-22808 Arizona Univ., Tucson.
A MINIMAL SENSITIVITY DESIGN METHOD FOR CONTROL SYSTEMS Ph.D. Thesis
David Haberman 1977 87 p
Avail: Univ. Microfilms Order No. 78-04896

The design method was based upon choosing from a set of acceptable transfer functions the one transfer function that had the lowest sensitivity measure. A transfer function was judged acceptable if the time response to a test input associated with it fell within a specified envelope. A set of acceptable transfer functions was defined within the framework of the theory of fuzzy sets, taking into account the closed loop response as well as the sensitivity measure. The most desirable transfer function was chosen from this set of output equivalent transfer functions. A detailed design example is presented, and extensions to time varying and multivariable systems are discussed. Dissert. Abstr.

N78-22809*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ORACLS: A SYSTEM FOR LINEAR-QUADRATIC-GAUSSIAN CONTROL LAW DESIGN
Ernest S. Armstrong Apr. 1978 198 p refs
(NASA-TP-1106; L-11769) Avail: NTIS HC A09/MF A01 CSCL 09B

A modern control theory design package (ORACLS) for constructing controllers and optimal filters for systems modeled by linear time-invariant differential or difference equations is described. Numerical linear-algebra procedures are used to implement the linear-quadratic-Gaussian (LQG) methodology of modern control theory. Algorithms are included for computing eigensystems of real matrices, the relative stability of a matrix, factored forms for nonnegative definite matrices, the solutions and least squares approximations to the solutions of certain linear matrix algebraic equations, the controllability properties of a linear time-invariant system, and the steady state covariance matrix of an open-loop stable system forced by white noise. Subroutines are provided for solving both the continuous and discrete optimal linear regulator problems with noise free measurements and the sampled-data optimal linear regulator problem. For measurement noise, duality theory and the optimal regulator algorithms are used to solve the continuous and discrete Kalman-Bucy filter problems. Subroutines are also included which give control laws causing the output of a system to track the output of a prescribed model. Author

N78-22810# Texas Instruments, Inc., Dallas.
AUTOMATIC LANGUAGE DISCRIMINATION Final Technical Report, Mar. 1976 - Aug. 1977
R. Gary Leonard and George R. Doddington Jan. 1978 81 p refs
(Contract F30602-76-C-0168)
(AD-A050841; TI-08-77-46; RADC-TR-78-5) Avail: NTIS HC A05/MF A01 CSCL 05/7

A language discrimination algorithm was developed that utilizes single steady-state phoneme-like reference sounds. The algorithm makes use of the relative frequency of occurrence of these reference sounds and nearest-mean decision strategy. The reference sounds were determined interactively and have been shown to have good language specificity. The number of reference sounds required is small enough to allow real-time operation. Standardization of each speaker's long-term average spectrum removed much of the data variation that was due to variations in data recording conditions. This standardization provided a 41 percent decrease in the number of test speaker misclassifications. In a performance test involving 50 test speakers of five languages, 80 percent correct classification was achieved. Excellent discrimination among L1, L3, and L5 was attained,

while additional references with more language specificity are needed for discriminating between L2 and L4. Author (GRA)

N78-22811# California Univ., Irvine. Dept. of Electrical Engineering.
THEORY OF STOCHASTIC OPTIMAL TRACKING SYSTEMS Ph.D. Thesis
Vaqar H. Syed Dec. 1977 108 p refs
(Grants AF-AFOSR-2116-71; NSF ENG-73-03729; AF Proj. 2304)
(AD-A050575; UCI-EE-7708; AFOSR-76-0147TR) Avail: NTIS HC A06/MF A01 CSCL 09/3

The object is to study the optimal tracking of signals modeled as stochastic processes, by linear plants. The signal available to the plant is a given stochastic process in the presence of a white noise. The criterion for optimization is the minimization of the original stochastic process and the plant output. The study thus involves the design of appropriate compensators to give the systems the desired tracking properties. The present theory of stochastic optimal tracking, in the mean-square sense, only considers stationary systems. The main thrust of this work is to extend the existing theory to include nonstationary systems. Thus nonstationary stochastic processes, time-varying plants and sensors, and arbitrary initial times are admissible in this work. Moreover, due to the nonstationary nature of the systems, state-space techniques are exclusively used here. The systems in the open-loop as well as the closed-loop configurations are studied. For each case, the appropriate compensators are designed both in terms of their impulse response functions and in terms of their state-space realizations. Finally, the conditions for the stability of the resulting systems are derived. GRA

N78-22812# Research Inst. of National Defence, Stockholm (Sweden).
ANALYSIS OF NONLINEAR CONTROL SYSTEMS USING THE NEW CONCEPT OF SPECIFIC DESCRIBING FUNCTION
Lennart Brandqvist Jul. 1977 20 p
(FOA-C-20188-E4) Avail: NTIS HC A02/MF A01

If one signal into a nonperiodic driven nonlinear control system loop is known, for instance, by measurements, the nonlinear link can be described by a specific describing function. The nonlinear link can then be treated as an entirely linear link, using, for example, Laplace transforms in the determination of the input and output of the link. All other signals in the system can thereby be calculated and, also, the specific stability of the system can be determined, using ordinary linear analysis methods. Author (ESA)

N78-22813# European Space Agency, Paris (France).
CONSIDERATIONS ON THE ROBUSTNESS OF CONTROL SYSTEMS
Gerhard Kreisselmeier Feb. 1978 35 p refs Transl. into ENGLISH of 'Ueberlegungen zur Robustheit von Regelungssystemen, DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-55277/19, Jun. 1977 Original report in GERMAN previously announced as N78-15758
(ESA-TT-453; DLR-IB-552-77/19) Avail: NTIS HC A03/MF A01

Conditions for the existence of linear robust controller for linear systems are discussed, a computerized procedure for the calculation of robust controllers is presented, and possibilities for optimizing robust controllers are dealt with. A robust controller is a controller which controls the system in a stable way even when one of the sensors is out of order without this being noticed and remedied by switching. Results of the study show a possible advantage of multiloop control cycles over single loop control cycles. ESA

N78-22730# Joint Publications Research Service, Arlington, Va.
HIGHER CONTROL SYSTEM SAVINGS VIA CENTRALIZATION OF COMPUTER FACILITIES URGED
N. M. Akhmadeyeva, T. M. Bodyanskaya, and V. M. Simchera *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 29 (JPRS-70659) 21 Feb. 1978 p 27-35 refs Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 8, 1977 p 7-10 (For availability see N78-22726 13-59)
Avail: NTIS HC A05/MF A01

N78-23030*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STABILITY OF CONSTANT GAIN SYSTEMS WITH VECTOR FEEDBACK
George L. vonPragenau *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 443-471 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 12B

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-22814 Cornell Univ., Ithaca, N. Y.
COMPLEXITY OF FINITELY PRESENTED ALGEBRAS Ph.D. Thesis
Dexter Campbell Kozen 1977 103 p
Avail: Univ. Microfilms Order No. 7801663

A finitely presented algebra is a set with various operations of various finite arities, which were described by a finite set of defining relations. Finitely presented algebras applied to the study of equational logic, semantics of programming languages, and formal language theory. Most importantly, many finitary structures of interest to computer science, such as graphs, were represented as finitely presented algebras, and a large number of natural decision problems known to be complete for P, NP, etc., were special cases of natural decision problems about finitely presented algebras which were complete for the same classes. Graph isomorphism and isomorphism of finitely presented algebras are polynomial time equivalent. The techniques developed show that deciding validity of positive sentences of first order predicate logic with equality is NP complete. Dissert. Abstr.

N78-22815 California Univ., San Diego.
POLYNOMIALS OF BINOMIAL TYPE AND THE LAGRANGE INVERSION FORMULA Ph.D. Thesis
Joni Abbey Shapiro 1977 104 p
Avail: Univ. Microfilms Order No. 77-32836

The central idea motivating this work is the realization that polynomials of binomial type and the Lagrange inversion formula are intimately connected. Several Lagrange-type inversion formulas are obtained. In particular, a very general n-dimensional Lagrange inversion formula is obtained. Within this setting, no convergence requirements are needed. In addition, no special assumption about the system of formal power series to be inverted are made other than the natural condition that the Jacobian be different from zero at the origin. Several applications are given. In particular, a new proof of the MacMahon master theorem is obtained; explicit formulas for higher dimensional analogues of the Laguerre, Abel and lower factorial polynomials are given; and certain colored planar trees are enumerated. Dissert. Abstr.

N78-22816 California Univ., San Diego.
UPDATING THE SYMMETRIC INDEFINITE FACTORIZATION WITH APPLICATIONS IN A MODIFIED NEWTON'S METHOD Ph.D. Thesis
Danny Chris Sorensen 1977 155 p
Avail: Univ. Microfilms Order No. 77-32838

A numerical algorithm is presented for updating the Symmetric Indefinite Factorization of Bunch and Parlett. An error analysis of this algorithm is given. Computational results are presented that investigate the timing and accuracy of this algorithm. Another algorithm is presented for the unconstrained minimization of a nonlinear functional. The algorithm is a modification of Newton's method. At points where the Hessian is indefinite the search for the next iterate is conducted along a quadratic curve in the plane spanned by a direction of negative curvature and a gradient related descent direction. The stopping criteria for this search take into account the second order derivative information. The result is that the iterates are shown to converge globally to a critical point at which the Hessian is positive semidefinite.
Dissert. Abstr.

N78-22817 Lehigh Univ., Bethlehem, Pa.
IMAGINARY QUADRATIC NUMBER FIELDS WITH SPECIAL CLASS GROUPS Ph.D. Thesis
James Joseph Solderitsch 1977 136 p
Avail: Univ. Microfilms Order No. 7800842

For any prime p > or = 3, relationship between two Diophantine equations of degree p was used to produce a homogeneous polynomial of degree 2p in two variables. This polynomial was used to generate discriminants of imaginary quadratic number fields whose ideal class groups may contain subgroups of type C(p) x C(p). Sufficient conditions for this behavior were investigated. For each p, infinitely many fields with such class groups were constructed. The class groups for many small discriminants produced in this manner were analyzed by a computer program. Several examples of fields with class groups containing C(5)x C(5)x C(5) and C(3)x C(3)x C(3)x C(3) found by the program among these discriminants are discussed. The present computer implementation is described. Dissert. Abstr.

N78-22818 Michigan State Univ., East Lansing.
SOME PARTIAL DIFFERENTIAL EQUATIONS WITH DELAY Ph.D. Thesis
David Richard Hale 1977 83 p
Avail: Univ. Microfilms Order No. 7803494

Several physical models are discussed which lead to partial differential equations with delay. A more general equation is considered at first and then formally transformed into a second equation. This equation is shown to have a unique solution for appropriate initial conditions. A semigroup is defined using these solutions. The infinitesimal generator for this semigroup is found, and its spectrum computed. It is shown that the solution of the modified equation gives solutions of the original equation when A = delta and the solution is in a weak sense. Existence and uniqueness for the nonhomogeneous linear equation and the perturbed equation is discussed along with a saddle point property for the perturbed equation. Dissert. Abstr.

N78-22819 California Univ., Los Angeles.
A THEORY OF MATHEMATICAL CLASSIFICATION Ph.D. Thesis
Enrique Hector Ruspini 1977 205 p
Avail: Univ. Microfilms Order No. 7802603

The problem of classifying points of a subset (the sample set) of a certain space (the reference space) into classes (called clusters) was considered. The basis for the development in the space. This structure is expressed by a known function that maps pairs of points of the Reference Space into nonnegative real values. A rigorous mathematical theory was presented for this problem, in order to provide a basis for meaningful development of classificatory procedures. This theory was developed for general (i.e., nonnecessarily finite) sample sets to allow for future studies of statistical nature relating the classification of a general set with that of its finite sample.
Dissert. Abstr.

N78-22820 Columbia Univ., New York.
ALGORITHMS FOR THE SOLUTION OF THE SPARSE EIGENVALUE PROBLEM Ph.D. Thesis
Thomas Vergil Papathomas 1977 109 p
Avail: Univ. Microfilms Order No. 78-04381

A two stage scheme was developed for solving the standard eigenproblem. The matrix whose eigenvalues were desired was first reduced to the Hessenberg form by a series of elementary transformations. A class of algorithms were developed which produce sparse Hessenberg matrices with numerical stability control. In the second stage, the eignevalues of H were found using Laguerre's root finding method, and an appropriate variant of hyman's method. Implicit deflation formulas were developed and employed to achieve uniform accuracy for all the roots.
Dissert. Abstr.

N78-22821 California Univ., Los Angeles.
EXPERIMENTAL INVESTIGATION OF HOT ELECTRON EMISSION FROM A SILICON P-N JUNCTION Ph.D. Thesis
Iradj Shahriary 1977 143 p
Avail: Univ. Microfilms Order No. 78-02604

The n layer thickness was reduced in calibrated steps by argon sputtering. After each sputtering the surface was annealed and activated with cesium and oxygen to reduce the work function. Energy distributions, for several reverse biases, were then measured. The magnitude of the energy distribution curves varied exponentially with the n layer thickness with an attenuation length of 350A. The average energy of the electrons increased linearly and the standard deviation of the distribution decreased linearly with decreasing n-layer thickness. Thes experimental results are consistent with the theorectical predictions of Baraff. By relating the experimental data to Baraff's theory, an optical phonon mean free path of 150 plus or minus 10A was found. Dissert. Abstr.

N78-22822 Michigan Univ., Ann Arbor.
RATE DISTORTION FUNCTIONS FOR CONTINUOUS ALPHABET MEMORYLESS SOURCES Ph.D. Thesis
Stephen Lynn Fix 1977 127 p
Avail: Univ. Microfilms Order No. 78-04697

The magnitude error distortion measure and the squared error distortion measure are discussed in an evaluation of the rate distortion function (R(d)) for continuous alphabet memoryless sources. Along with these particular cases, the general properties of R(d) and the equations to be solved are presented, and the existence of a solution considered. The magnitude error distortion measure yields an integral equation which can be solved by known techniques. For the squared error distortion measure, the kernel of the resulting integral equation is of a form which, in general, cannot be solved by known techniques. Here the analytic properties of the kernel are utilized to specify the form the solution must have. The solution in all computational cases must have a finite reproduction alphabet. A procedure for evaluating R(d) is given. The example of a uniform source is presented. Dissert. Abstr.

N78-22823 Johns Hopkins Univ., Baltimore, Md.
REPRESENTATION AND REALIZATION OF HOMOGENEOUS NONLINEAR SYSTEMS Ph.D. Thesis
Glenn Earle Mitzel 1978 169 p
Avail: Univ. Microfilms Order No. 7806264

Realizations of degree n homogeneous systems in terms of linear subsystems, multipliers, and adders were studied. The S transform theory was useful in providing both realizability tests and constructive realization procedures. A new representation, defined for homogeneous systems, proves significant both in realization theory and in the representation of input-output behavior of homogeneous systems. The main results were presented for degree n homogeneous systems, although additional special results for the degree two case were discussed.
Dissert. Abstr.

N78-22824*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ESTIMATION FROM INCOMPLETE MULTINOMIAL DATA Ph.D. Thesis - Harvard Univ.
Karen Rackley Credeur Jan. 1978 358 p refs
(NASA-TM-78703) Avail: NTIS HC A16/MF A01 CSCL 12A

The vector of multinomial cell probabilities was estimated from incomplete data, incomplete in that it contains partially classified observations. Each such partially classified observation was observed to fall in one of two or more selected categories but was not classified further into a single category. The data were assumed to be incomplete at random. The estimation criterion was minimization of risk for quadratic loss. The estimators were the classical maximum likelihood estimate, the Bayesian posterior mode, and the posterior mean. An approximation was developed for the posterior mean. The Dirichlet, the conjugate prior for the multinomial distribution, was assumed for the prior distribution. Author

N78-22825# Lockheed Missiles and Space Co., Palo Alto, Calif.
ALGORITHM TO FIND THE MINIMUM SKELETON OF A GROWING GRAPH
G. B. Roshchin [1977] 5 p ref Transl. into ENGLISH from Vychisl. Mat. i Matem. Fiz. (USSR), v. 17, no. 6, 1977 p 1607-1610
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

An algorithm was proposed for rearrangement of the minimum skeleton of a graph with n vertices in O (n) operations

upon the addition of a new vertex and its incident ribs to the graph. Author

N78-22826# Royal Aircraft Establishment, Farnborough (England).
BOUNDARY AND INITIAL CONDITIONS FOR MATRICES USED FOR LOAD SEQUENCE GENERATION
H. G. Koebler and R. Fischer Dec. 1977 14 p refs Transl. into ENGLISH from paper by Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany), 1977 14 p Presented at the Appl. of Methods Assessing Service Strength, Darmstadt, West Germany, Feb. 1977
(RAE-Lib-Trans-1959; BR62235) Avail: NTIS HC A02/MF A01

The computerized synthesis of a sequence of peaks and troughs from a matrix scheme was used in order to generate pseudorandom load time histories for fatigue testing. The matrix elements containing the frequencies of transitions between subsequent peaks and troughs resulted from an analysis of a service load record. The handling of a transition matrix as necessary to generate a sequence of peaks and troughs was done in a manner of lotting. There are two different principles to note; the lotting without or with restoration of lots. Sequences of pseudorandom numbers were used. In order to assure the complete realization of the transition frequencies required and its reliable reproducibility some particularities were observed, which were illustrated by elementary examples. Author

N78-22827# Stanford Univ., Calif. Dept. of Electrical Engineering.
SQUARE-ROOT ALGORITHMS FOR MODEL SENSITIVITY ANALYSIS Interim Report
M. Morf, E. Verriest, J. Dobbins, and T. Kailath Mar. 1977 8 p refs Proc. of the Conf. on Inform. Sciences and Systems, Johns Hopkins Univ., Md., 30 Mar. - 1 Apr. 1977
(Contracts F44620-74-C-0068; N00014-75-C-0601)
(AD-A050975; AFOSR-78-0307TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The Morf-Kailath discrete square-root filtering algorithms are extended to incorporate sensitivity information with respect to the assumed model and statistics are available and considered to be the actual model. The sensitivity analysis is carried out by computing the so-called variance ratios that can be obtained by a second set of orthogonal transforms. These operations can be performed either in covariance or information filter form, as the actual filters. This leads to four basic variants for the propagation of the variance ratios. These ideas can also be applied to other related areas such as smoothing and the dual control problems, where it is of interest to study the sensitivity of the total cost with respect to different models and weights of the cost. GRA

N78-22828# Naval Health Research Center, San Diego, Calif.
ARDIE LUBIN ON LINEAR REGRESSION: THE PRODUCT-MOMENT CORRELATION AND THE ONE-PREDICTOR LINEAR REGRESSION MODEL Interim Report
Van K. Tharp, Jr. Nov. 1977 38 p refs
(AD-A050651; Rept-77-41) Avail: NTIS HC A03/MF A01 CSCL 12/1

This Center Technical Report is divided into three parts. A series of definitions and formulas necessary for understanding and computing the product-moment correlation are presented in Part 1. In Part 2, the historical development of the linear regression model is presented, illustrating various models and their assumptions. Finally, Part 3 contains Ardie Lubin's statement of ethics for using statistics in research and a series of diagnostic checks for the one-predictor linear regression model.
Author (GRA)

N78-22829# Utah Univ., Salt Lake City. Dept. of Mathematics.
A SINC-GALERKIN METHOD OF SOLUTION OF BOUNDARY VALUE PROBLEMS
Frank Stenger Aug. 1977 39 p refs
(Grant DAAG29-76-G-0210)
(AD-A050662; ARO-11471.14-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper illustrates the application of a Sinc-Galerkin method to the approximate solution of linear and nonlinear second order ordinary differential equations, and to the approximate solution of some linear elliptic and parabolic partial differential equations in the plane. The method is based on approximating functions and their derivatives by use of the Whittaker cardinal function. The DE is reduced to a system of algebraic equations via new accurate explicit approximations of the inner products, the evaluation of which does not require any numerical integration. Using n function evaluations the error in the final approximation to the solution of the DE is 0 - exp (-c(n to the 1/2 d power)) = where c is independent of n, and d denotes the dimension of the region on which the DE is defined. This rate of convergence is optimal in the class of n-point methods which assume that the solution is analytic in the interior of the interval, and which ignore possible singularities of the solution at the end-points of the interval. Author (GRA)

N78-22830# Rice Univ., Houston, Tex. Dept. of Mechanical Engineering.
NEW TECHNIQUES IN NUMERICAL ANALYSIS AND THEIR APPLICATION TO AEROSPACE SYSTEMS Interim Report, 1 Sep. 1976 - 30 Sep. 1977
Angelo Miele 1977 32 p refs
(Grant AF-AFOSR-3075-76)
(AD-A050581; AFOSR-78-0158TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The objective of this investigation is to contribute to numerical techniques of interest in system theory in general and aerospace engineering in particular. Typical areas of mathematical research are: solution of nonlinear, algebraic or trascendental equations; solution of nonlinear, ordinary differential equations; solution of linear and nonlinear partial differential equations; mathematical programming problems; and optimal control problems. Typical areas of application are: numerical solution of optimum structural problems; numerical solution of optimum flight trajectories; and numerical solution of optimum aerodynamic shapes. Algorithms for digital computer usage are being developed and tested on IBM 370/155. GRA

N78-22831# Texas Univ., Austin. Center for Numerical Analysis.
ITPACK REPORT: NUMERICAL STUDIES OF SEVERAL ADAPTIVE ITERATIVE ALGORITHMS
David R. Kincaid and Roger G. Grimes Aug. 1977 93 p refs
(Grants DAHC04-74-G-0198; NSF MCS-76-03141)
(AD-A050879; ITR-CNA-126; ARO-12301.4-M) Avail: NTIS HC A05/MF A01 CSCL 09/2

Six adaptive iterative algorithms are studied for six elliptic partial differential equations on six regions compatible with subroutine REGION. An effort was made to make the resulting preliminary ITPACK code conform to the 'ELLPACK Contributor's Guide--Initial Version,' CSD TR 208, Purdue University, November 1, 1976. Author (GRA)

N78-22832# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF INITIAL FUNCTIONS FOR TWO DIMENSIONAL BOUNDARY PROBLEMS OF THE THEORY OF ELASTICITY
V. A. Agarev 13 Sep. 1977 376 p refs Transl. into ENGLISH of the book "Metod Nachalnykh Funktsiy Dlya Dvumernykh Krayevykh Zadach Teorii Uprugosti" Kiev, Akademii Nauk Ukrainskoy SSR izd., 1963 p 1-175 and 178-203
(AD-A050744; FTD-ID(RS)T-0553-77) Avail: NTIS HC A17/MF A01 CSCL 12/1

A detailed analysis of the basic works on the ideas of the method of initial functions was carried out. The basis of the theory of the operators in connection with the method of the initial functions was developed and the possibility of a double approach to the introduction of the concept of the operators was shown. The equivalency of the representation of the operators in the closed form and in the form of series was demonstrated, also the legitimacy of the action above operational series. A series of formulas which express the properties of the operators was obtained. Specific rules for the actions with the operators was established and methods for the realization of operators was developed. A considerable quantity of formulas were obtained which facilitate the practical application of the

operators and the possibility of obtaining some new identities for Bessel functions was shown. Author

N78-22833# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
DELETION OF PRINCIPAL COMPONENTS IN REGRESSION Interim Report
R. F. Gunst and J. T. Webster 1978 24 p refs
(Grant AF-AFOSR-2871-75)
(AD-A050576; AFOSR-78-0152TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two techniques generally advocated for the deletion of principal components in regression analysis are: delete components associated with small latent roots X:X; and delete components following nonrejection of a statistical test of the significance of the components. The estimator corresponding to the first procedure is referred to as a restricted least squares estimator and that associated with the second is called a preliminary test estimator. Properties of these estimators are examined in this paper with special attention to the effects of multicollinearities on the preliminary test estimator. The restricted estimator is recommended for use unless inferences on the noncentrality parameter of the preliminary test clearly indicate that the test will have adequate power. GRA

N78-22834# Princeton Univ., N. J. Plasma Physics Lab.
WKB: AN INTERACTIVE CODE FOR SOLVING DIFFERENTIAL EQUATIONS USING PHASE INTEGRAL METHODS
R. B. White Jan. 1978 23 p refs
(Contract EY-76-C-02-3073)
(PPPL-1408) Avail: NTIS HC A02/MF A01

A small code for the analysis of ordinary differential equations interactively through the use of Phase Integral Methods (WKB) was written for use on the DEC 10. A descriptive manual for those interested in using the code is presented. ERA

N78-22835# Sandia Labs., Albuquerque, N. Mex.
SOLVING CERTAIN STIFF DIFFERENTIAL EQUATIONS BY TRANSFORMATION
Lawrence F. Shampine Oct. 1977 16 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1702) Avail: NTIS HC A02/MF A01

Methods for weakening the effects of stiffness when solving a single ordinary differential equation were studied. Particular attention was given to the kind of equation arising in the solution of Sturm-Liouville eigenvalue problems by shooting. A special transformation for this case was investigated and shown to increase efficiency greatly with respect to truncation errors as well as with respect to stiffness. ERA

N78-22836# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
STORAGE SPACE SAVING EDP PROGRAMS FOR SOLVING EQUATION SYSTEMS WITH SYMMETRIC COEFFICIENT MATRICES [SPEICHERPLATZ SPARENDE EDV-PROGRAMME ZUR AUFLOESUNG VON GLEICHUNGS-SYSTEMEN MIT SYMMETRISCHEN KOEFFIZIENTENMATRIZEN]
Dieter Ehlert 1977 65 p refs In GERMAN; ENGLISH summary
(Ser-B-222-Mitt-140) Avail: NTIS HC A04/MF A01

Subroutines formulated in ALGOL 60 are described for the determinant and indeterminant solution of systems of linear equations with symmetric coefficient matrices. In the core memory of the computer only those elements of the coefficient matrix are stored which are situated on and above, or on and below the principal diagonal. Besides a small necessary core, great importance is attached to high computation speed and to a check of the matrix condition. Author (ESA)

N78-22837# Montpellier Univ. (France). Dept. de Physique Mathematique.
CONNECTION BETWEEN ZAKHAROV-SHABAT AND SCHROEDINGER TYPE INVERSE SCATTERING TRANSFORMS
M. Jaulent and I. Miodek Aug. 1977 8 p refs
(PM/77/9) Avail: NTIS HC A02/MF A01

The inverse problem for the generalized Zakharov-Shabat equation and the inverse problem for the Schroedinger equation having an energy dependent potential were studied. Using their respective inverse scattering transforms it is shown that some nonlinear evolution equations can be solved. It is also shown that there is a one-to-one correspondence between the two inverse problems considered, as well as between the inverse scattering transforms. ESA

N78-22424 Karlsruhe Univ. (West Germany). Inst. fuer Geodaesie.
SOME CONSIDERATIONS USING INTERVAL ANALYSIS IN ADJUSTMENT COMPUTATIONS
Guenter Schmitt *In* Inst. fuer Angew. Geodaesie Further Contrib. from the Federal Rep. of Ger. to the 16th Gen. Assembly of the IUGG 1977 p 87-97 refs (For availability see N78-22415 13-42)
Avail: NTIS HC A04/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-22838 Pennsylvania State Univ., University Park.
A BAYESIAN PROCEDURE USING A MARGINAL PRIOR IN THE LOCATION AND SCALE PARAMETER FAMILY Ph. D. Thesis
David L. Wahrenberger 1977 120 p
Avail: Univ. Microfilms Order No. 7803377

A marginal Bayesian procedure was proposed for the selection of a decision rule when the sample information can be partitioned into two parts with one part having a marginal distribution which is free of the nuisance parameters. It is shown that this procedure satisfied the criteria of Blum and Rosenblatt when the decision rule selected was an extended Bayes rule relative to the class of prior distributions having the appropriate marginal prior. In addition, it was shown to be applicable when the model was a member of the LASP family and the parameter of interest is the scale paramenter or the reliability at some fixed time. Dissert. Abstr.

N78-22839 Purdue Univ., Lafayette, Ind.
ON SOME DECISION-THEORETIC CONTRIBUTIONS TO THE PROBLEM OF SUBSET SELECTION Ph.D. Thesis
Jason Chien Hsin Hsu 1977 79 p
Avail: Univ. Microfilms Order No. 78-03237

Ranking and selection procedures, subset selection procedures in particular, are procedures that provide in a realistic manner attractive ways of handling problems that are commonly treated by the 2-action procedure of a global F-test, and the many-action procedure of a typical multiple range test. It is generally recognized that for multivariate problems uniformly best procedures do not exist. Hence it is reasonable to look for procedures that do well on the average, averaged over the parameter space by some prior. This approach was been taken. The essentially complete class of Bayes procedures and their limits is investigated. Under successively stronger assumptions on the underlying distribution, the loss function, and the prior measure, the monotonicity of Bayes subset selection procedures is studied. Dissert. Abstr.

N78-22840# Florida State Univ., Tallahassee. Dept. of Statistics.
ESTIMATING DEPENDENT LIFE LENGTHS, WITH APPLICATIONS TO THE THEORY OF COMPETING RISKS Interim Report
N. Langberg, F. Proschan, and A. J. Quinzi Nov. 1977 36 p refs Prepared in cooperation with Temple Univ., Philadelphia, Pa.
(Grant AF-AFOSR-2581-74)
(AD-A050970; FSU-STATISTICS-M438; AFOSR-78-0276TR)
Avail: NTIS HC A03/MF A01 CSCL 12/1

In the classical theory of competing risks (as well as in many reliability models and incomplete data problems) it is assumed that the risks (i.e., the random variables of interest) are independent and that death does not result from simultaneous

causes. Employing the probabilistic solution to a related problem in probability modelling, strongly consistent estimators are obtained for the unobservable marginal distributions of interest. These estimators are appropriate when the assumptions of independence and no simultaneous causes of death fail to hold. These methods can be used to unify and simplify the nonparametric approach toward estimation in the competing risks model. GRA

N78-22841# Research Inst. of National Defence, Stockholm (Sweden).
FAST MULTIVARIABLE QUERY EVALUATION
Stefan Arnborg and Per Svensson Aug. 1977 80 p refs
(FOA-C-20189-D8) Avail: NTIS HC A05/MF A01

A multivariable query is a specification of a function on all k-tuples of records in a specified subset of a database. Evaluation of such functions is usually very time-consuming. Algorithms are analyzed which evaluate multivariable queries with minimal or nearly minimal cost, where cost is I/O transfer time, I/O wait time and CPU time, respectively. Author (ESA)

N78-22842# Research Inst. of National Defence, Stockholm (Sweden).
THE DOUBLE DANGER IN USING STANDARD ASYMPTOTIC MAXIMUM LIKELIHOOD THEORY IN THE PRESENCE OF INCIDENTAL PARAMETERS
Eva Elvers Aug. 1977 28 p refs
(FOA-C-20190-T1) Avail: NTIS HC A03/MF A01

Ordinary maximum likelihood estimators of so-called structural parameters (which appear in the distribution of all n observations) are, in general, not consistent when there are incidental parameters (which belong only to a finite number of observations). This fact is demonstrated first, with emphasis on functional relationship models. A method to modify the estimators, is shown to be valuable for a class of models. Some linear relationship models are given as examples, and two nonlinear models illustrate the opposite case. Then the asymptotic distribution of the estimators is discussed for consistent cases. It is multivariate normal under conditions, which concern not only regularity but also existence of limits for certain functionals on the sequence of incidental parameters. The covariance matrix, which involves such limits, is derived and contrasted with the inverse of the information matrix. Author (ESA)

N78-22843# Research Inst. of National Defence, Stockholm (Sweden).
ESTIMATION OF MULTIVARIATE LINEAR FUNCTIONAL AND STRUCTURAL RELATIONSHIPS
Eva Elvers Aug. 1977 40 p refs
(FOA-C-20191-T1) Avail: NTIS HC A03/MF A01

Maximum likelihood (ML) estimators of the parameters in multivariate linear relationships were investigated. Both structural and functional models were considered, with emphasis on the latter, for which an extension is also made to several parallel relationships. The ordinary ML estimators of the structural parameters (which are common to all observations) are not consistent in the functional model, and a modification method was successfully applied. Some restriction has to be imposed on the infinite sequence of incidental parameters (which describe true locations), if an asymptotic distribution is to be defined. The existence of limits for the first two moments is a sufficient condition, and the corresponding asymptotic distribution, which is normal, is derived. Its covariance matrix is not equal to the inverse of the information matrix. The obtained asymptotic distribution is shown to be analogous with that of a particular structural model, in which the true locations are randomly sampled from a normal population. All stochastic variables are here independent, and the errors of measurements are normally distributed. It is first assumed that all these errors have the same variance, but then the general case is studied, whereby at least three variables are needed and suffice for identifiability of the parameters. Numerical methods are indicated. Author (ESA)

N78-22844# Research Inst. of National Defence, Stockholm (Sweden).
A COMPARISON OF THE TWO DISCRIMINANTS 'PLUG-IN' AND 'LIKELIHOOD RATIO'
Eva Elvers Aug. 1977 23 p refs
(FOA-C-20192-T1) Avail: NTIS HC A02/MF A01

The two sample-based discriminants, generally called plug-in and likelihood ratio, respectively, were studied. They are both shown to converge to the best discriminant (which would be used in the ideal case of known parameters) with an increasing sample size, and how close they are asymptotically was investigated. Explicit expressions were derived for two models in frequent use, independent binary variables and multivariate normal distributions with a common covariance matrix.
Author (ESA)

N78-22845# Research Inst. of National Defence, Stockholm (Sweden).
DISCRIMINATION BETWEEN TWO MULTIVARIATE PARALLEL LINEAR RELATIONSHIPS
Eva Elvers Aug. 1977 26 p refs
(FOA-C-20193-T1) Avail: NTIS HC A03/MF A01

A sample-based classification rule was investigated for discrimination between two multivariate functional relationship models of parallel lines. It is a plug-in version of a rule with the following properties. The discriminant is linear, each classification probability is independent of the corresponding incidental parameter (which describes the true location on the relation line), and one error probability has a prescribed value. The two last properties cannot be strictly preserved by such a sample based rule. The conditional error probabilities, which are relevant when using the rule, are given explicitly. The conditioning on the sample is through parameter estimates, obtained by a modified maximum likelihood method. The distributions of the classification probabilities, with respect to the estimator distribution, are derived asymptotically, i. e., for large samples. They are normal with the so-called right expected values and with their variances influenced by several factors, two important ones of which are the set of sample incidental parameters and the number of structural parameters that describe the distributions around the two relation lines. The usefulness of the results for various purposes is discussed, such as estimation of the actual (conditional) error probabilities and choice of a best discriminatory subset of the variables. Author (ESA)

N78-22846# Research Inst. of National Defence, Stockholm (Sweden).
DISCRIMINATION BETWEEN TWO MULTIVARIATE PARALLEL LINEAR RELATIONSHIPS WHEN A VARIABLE IS CENSORED
Eva Elvers Aug. 1977 22 p refs
(FOA-C-20194-T1) Avail: NTIS HC A02/MF A01

Consequences of censoring a variable from below at a fixed point t were studied when discriminating between two multivariate parallel linear functional relationships. When the variable is missing, partial information on its value is provided by t since it is an upper bound. A few different classification rules in this case are considered: a likelihood ratio procedure, a linear discriminant based only on the observed values, another linear discriminant which regards t as an observation, and a combined use of these two rather extreme choices. Error probabilities are derived and compared, partly with the aid of a numerical example, which has a seismological origin (with the point of censoring corresponding to a noise level). The classification probabilities are functions of the corresponding incidental parameter, which describes true location on the relation line. The various cut-off points of the discriminants are chosen according to an upper bound to one error probability. The value of utilizing the partial information is manifested by the second probability of misclassification. None of the investigated rules is generally best, since the probability curves have different forms. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-22847 George Washington Univ., Washington, D. C.
BICONVEX PROGRAMMING AND BICONCAVE MINIMIZATION Ph.D. Thesis
Faiz Abdullah Al-Khayyal 1977 121 p
Avail: Univ. Microfilms Order No. 78-01061

The properties and applications of a new class of problems, called biconvex programs, which contain all bilinear and all convex programs are investigated. Biconvex programs involve the minimization of biconvex functions over biconvex sets, where biconvex functions and sets are defined as natural extensions of convex functions and sets. Biconcave functions are similar extensions of concave functions. A detailed description of an algorithm for solving a large subclass of biconvex programs is given with a proof of convergence included. The algorithm is of the branch and bound type and solves a sequence of convex programs. A modification to the algorithm permits the solution of certain biconcave minimization problems. A FORTRAN code that implements the algorithm for the bilinear case is appended. Dissert. Abstr.

N78-23031*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYNTHESIS OF FINITE SETTLING TIME DISCRETE SYSTEMS
James A. Gatlin *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 473-494 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 12B

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-22848 Oklahoma Univ., Norman.
SOME BASIC PROPERTIES OF LEFT ALGEBRAIC GROUPS, BI-ALGEBRAIC GROUPS AND ALGEBRAIC GROUPS Ph.D. Thesis
Zensho Nakao 1977 88 p
Avail: Univ. Microfilms Order No. 77-32875

Left algebraic groups were first introduced into algebraic groups by A. Magid. This thesis continues the work of Magid on the theory of left algebraic groups. Also it introduces bi-algebraic group structure in which both the left and right translations by group elements are all morphisms and studies the following problems: Suppose G is a bi-algebraic group over an algebraically closed field K. (1) the group multiplication is or is not a morphism, (2) the group inversion is or is not a morphism, (3) the dependence or independence of (1) and (2). The problems were examined in a general setting where the given bi-algebraic group is almost affine as a variety. Dissert. Abstr.

N78-22849*# Houston Univ., Tex. Dept. of Mathematics.
A FIXED POINT THEOREM FOR CERTAIN OPERATOR VALUED MAPS
D. R. Brown and M. J. OMalley Mar. 1978 9 p refs
(Contract NAS9-15000)
(NASA-CR-151698; Rept-69) Avail: NTIS HC A02/MF A01 CSCL 12A

In this paper, we develop a family of Neuberger-like results to find points z epsilon H satisfying L(z)z = z and P(z) = z. This family includes Neuberger's theorem and has the additional property that most of the sequences [q sub n] converge to idempotent elements of B sub 1(H). Author

N78-22850# Maryland Univ. Baltimore County, Baltimore. Dept. of Mathematics.
DETECTION, ESTIMATION AND CONTROL ON GROUP MANIFOLDS Interim Report, 1 Jun. 1975 - 31 May 1977
James T. Lo 1978 14 p
(Grant AF-AFOSR-2671-74; AF Proj. 2304)
(AD-A050578; AFOSR-78-0155TR; IR-2; IR-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

The drive to develop the full strength of the exponential Fourier densities (EFD:s) was continued. The EFD:s have been successfully applied to the projective 2-space which is the state space of an axial process. The results were generalized to n-dimensional system. More striking was the generalization to an arbitrary compact lie group. A great deal of time was spent to the estimation problem of continuous-time rotational processes. No significant conclusions were reached and the effort was given up at the end of the reporting period. In its place an investigation of the lack of closure property of EFD's was started. The convolution of an EFD(n) and an EFD(1) was tested for EFD(n)'s on the circle. It was confirmed that for n = 1 and 2, the convolution of an EFD(n) and an EFD(1) was uniformly very close to an EFD(n). GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-22851 Columbia Univ., New York.
STIMULATED RAMAN SCATTERING BY AN INTENSE RELATIVISTIC ELECTRON BEAM IN A LONG RIPPLED MAGNETIC FIELD Ph.D. Thesis
Philip Charles Efthimion 1977 138 p
Avail: Univ. Microfilms Order No. 78-02299

For the first time, the parametric coupling of the negative energy cyclotron and space-charge modes to a fast coaxial waveguide structure was observed. The coaxial waveguide smooth center conductor was internally loaded to maintain a 5% ripple of 1.4, 1.6, or 2.0 cm periods on the background axial magnetic field throughout the interaction region of 70 cm. As predicted by theory, the frequency of the microwave radiation generated by the negative energy cyclotron mode decreases with increasing magnetic field while remaining constant for the negative energy space-charge mode. Power levels from 1 - 5 MW were measured at mm and cm wavelengths. This mechanism could be employed as a tunable generator of submillimeter and infrared wavelength radiation. Dissert. Abstr.

N78-22852 Illinois Univ., Urbana-Champaign.
ELECTROMAGNETIC PENETRATION DEPTH IN SUPERCONDUCTING ALLOYS CONTAINING MAGNETIC IMPURITIES Ph.D. Thesis
James William Thomasson 1977 222 p
Avail: Univ. Microfilms Order No. 78-04175

Measurements of the attenuation of an axial magnetic field by cylindrical, thin, superconducting films were made by using a SQUID-based magnetometer. The sample films were between 40 and 85 A thick. They were composed of indium and of indium containing a small amount of gadolinium. Each film was made by flash-evaporating pellets and quench-condensing the film onto a substrate. Correction terms were calculated numerically to transform the attenuation measurements for the finite-length sample into equivalent values for a hypothetical, infinitely long sample. The film thickness was determined from the temperature dependence of the film resistance. The electron mean free path was determined from the normal-state resistance at low temperatures. The electro-magnetic penetration depth, the reduced penetration depth, and the London penetration depth were determined. Dissert. Abstr.

N78-22853# Weapons Research Establishment, Adelaide (Australia).
INFLUENCE OF GRAVITY AND APPLIED SIDE FORCES ON THE STABILITY OF A SPINNING PROJECTILE
K. H. Lloyd and D. P. Brown Nov. 1977 24 p refs
(WRE-TR-1906(W)) Avail: NTIS HC A02/MF A01

The nonlinear equations of motion of a spinning projectile are linearized by a method different from that traditionally used. Extra terms are retained, giving a more complete description of the shell behavior and revealing some new information on stability. The resulting equations are solved as an eigenvalue problem, because this method of solution is the least tortuous and produces a good insight into the dynamic behavior of the shell. The stability of the precessional and nutational modes is shown to be influenced by gravity and applied side forces. Results of numerical simulations which confirm these conclusions are given. Author

N78-22854*# Williams Coll., Williamstown, Mass.
STUDY OF IMPROVEMENT OF HYDROGEN MASER FREQUENCY STANDARD Final Report
Stuart B. Crampton 1 Oct. 1977 20 p refs
(Contract NAS5-23520)

(NASA-CR-156747) Avail: NTIS HC A02/MF A01 CSCL 20J

The research work dealt primarily with reducing the atom leakage rate using as storage surfaces the FEP Teflon surfaces conventionally used in contemporary hydrogen maser frequency standards. Some work was also done on a possible alternative to the conventional surfaces, but the results here and elsewhere suggest that the alternative surface is not promising enough to warrant much further work. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-22855 Pennsylvania State Univ., University Park.
ULTRASONIC SHEAR VISCOMETER FOR LIQUID DROPLETS AND ITS APPLICATIONS Ph.D. Thesis
Edward Shalis 1977 84 p
Avail: Univ. Microfilms Order No. 78-03368

An ultrasonic viscometer, capable of measuring small liquid volumes such as drops, was developed by utilizing the short effective path length of shear waves in liquids. The viscometer consists of an unplated quartz crystal excited to shear vibrations with the liquid drop to be tested placed on its surface. Measurements were made on a variety of normal liquids and bonding agents over the frequency range from 200 to 1000 kHz, and the dynamic viscosity results scattered about the static value. A number of body fluids of man and domestic animals were examined. The response of the shear viscometer to changes in the rheological properties of bovine red blood cells was also measured. That is, the ability of red cells to deform was changed by hematological methods and the viscosity was measured before and after. It was found that the viscosity increased with the addition of sodium oleate, acetaldehyde, and hematocrit. Dissert. Abstr.

N78-22856 Pennsylvania State Univ., University Park.
EXPERIMENTAL INVESTIGATION OF THE SOUND FIELD MODULATION PHENOMENON OF A ROTATING DIFFUSER Ph.D. Thesis
Kenneth Paul Roy 1977 342 p
Avail: Univ. Microfilms Order No. 7803362

A simple model was developed for the rotating diffuser in the free field based upon its similarities with the oscillating plane reflector. The modulation phenomenon was investigated using this model which predicts the characteristics of the modulated signal spectra: the sideband frequency spacing and the relative sideband amplitudes. The parameters found to affect the modulated signal spectra include: (1) the diffuser speed of rotation; (2) the diffuser configuration, size, and surface area; (3) the source frequency; (4) the scattering angle; and (5) the diffuser scattering function. It is found that the complexity of the enclosure mutual interactions of the rotating diffuser and the enclosure environment boundaries makes it difficult to predict the effects of a particular diffuser on the yound field excited in the enclosure. Therefore, neither the spectrum shape nor the bandwidth is accurately predicted for the modulated signal in the reverberant room from the results observed in the free field. The best indicator of the diffuser effectiveness is found to be the chamber qualification analysis. Dissert. Abstr.

N78-22857+ Societe Bertin et Cie, Plaisir (France). Dept. Acoustique et Insonorisation Industrielle.
PREDICTION AND CONTROL OF THE NOISE GENERATED BY CENTRIFUGAL FANS Final Report [PREVISION ET CONTROLE DU BRUIT DES VENTILATEURS CENTRIFUGES]
Robert Cubaud and Pierre Bonnet Aug. 1976 128 p refs In FRENCH; ENGLISH summary
Avail: NTIS HC A07

A systematic analysis of research on sound generated by centrifugal fans, and a more general study based on sound generated aerodynamically (Lighthill, Curle, Doak) was made, leading to a coherent synthesis of the results of different authors and an explanation of their divergences. Author (ESA)

N78-22858*# Minnesota Univ., Minneapolis. Saint Anthony Falls Hydraulic Lab.
ON AN ACOUSTIC FIELD GENERATED BY SUBSONIC JET AT LOW REYNOLDS NUMBERS
Kingo Yamamoto and Roger E. A. Arndt Mar. 1978 215 p refs
(Grant NGR-39-009-270)
(NASA-CR-156182; Proj-Rept-170) Avail: NTIS HC A10/MF A01 CSCL 20A

An acoustic field generated by subsonic jets at low Reynolds numbers was investigated. This work is motivated by the need to increase the fundamental understanding of the jet noise generation mechanism which is essential to the development of further advanced techniques of noise suppression. The scope of this study consists of two major investigation. One is a study of large scale coherent structure in the jet turbulence, and the other is a study of the Reynolds number dependence of jet noise. With this in mind, extensive flow and acoustic measurements in low Reynolds number turbulent jets (8,930 less than or equal to M less than or equal to 220,000) were undertaken using miniature nozzles of the same configuration but different diameters at various exist Mach numbers (0.2 less than or equal to M less than or equal to 0.9). Author

N78-22859*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ACOUSTIC DRIVING OF ROTOR Patent Application
Hilda Kanber (JPL), Isadore Rudnick (JPL), and Taylor G. Wang, inventors (to NASA) (JPL) Filed 5 Jul. 1977 9 p
(Contract NAS7-100)
(NASA-Case-NPO-14005-1; US-Patent-Appl-SN-812447) Avail: NTIS HC A02/MF A01 CSCL 20A

The object of the invention is to provide a system for utilizing sound to rotate a suspended object, with large and controlled torque. An enclosure of square cross-section is utilized together with transducers at walls which are at right angles to each other. A circuit drives the transducers at the same frequency, but at a constant phase difference such as 90 deg. This causes rotation of air molecules and therefore, rotation of a shaft which extends through the enclosure, as a first order effect. The torque or speed of rotation are controlled by controlling the intensity at which the transducers are driven. The major novel feature of this invention is the driving of two transducers on orthogonal walls of an enclosure of square cross section, at the same frequency but at a constant phase difference, to produce torque as a first order effect. NASA

N78-22860*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REDUCTION OF FAN NOISE IN AN ANECHOIC CHAMBER BY REDUCING CHAMBER WALL INDUCED INLET FLOW DISTURBANCES
J. H. Dittmar, M. J. Mackinnon, and R. P. Woodward 1978 20 p refs Presented at Acoust. Soc. Am. Meeting, Providence, R. I., 16-19 May 1978
(NASA-TM-78854; E-9580) Avail: NTIS HC A02/MF A01 CSCL 20A

The difference between the flight and ground static noise of turbofan engines presents a significant problem in engine noise testing. The additional noise for static testing has been attributed to inlet flow disturbances or turbulence interacting with the fan rotor. In an attempt to determine a possible source of inflow disturbances entering fans tested in the Lewis Research Center anechoic chamber, the inflow field was studied using potential flow analysis. These potential flow calculations indicated that there was substantial flow over the wall directly behind the fan inlet that could produce significant inflow disturbances. Fan noise tests were run with various extensions added to the fan inlet to move the inlet away from this backwall and thereby reduce the inlet flow disturbances. Significant noise reductions were observed with increased inlet length. Over 5 db reduction of the blade passage tone sound power level was observed between the shortest and longest inlets at 90% fan speed and the first overtone was reduced 9 db. High frequency broadband noise was also reduced. Author

N78-22861*# Aeronautical Research Associates of Princeton, Inc., N. J.

APPLICATION OF THE BERNOULLI ENTHALPY CONCEPT TO THE STUDY OF VORTEX NOISE AND JET IMPINGEMENT NOISE Final Report

John E. Yates NASA Washington Apr. 1978 84 p refs (Contract NAS1-14503)

(NASA-CR-2987) Avail: NTIS HC A05/MF A01 CSCL 20A

A complete theory of aeroacoustics of homentropic fluid media is developed and compared with previous theories. The theory is applied to study the interaction of sound with vortex flows, for the DC-9 in a standard take-off configuration. The maximum engine-wake interference noise is estimated to be 3 or 4 db in the ground plane. It is shown that the noise produced by a corotating vortex pair departs significantly from the compact M scaling law for eddy Mach numbers (M) greater than 0.1. An estimate of jet impingement noise is given that is in qualitative agreement with experimental results. The increased noise results primarily from the nonuniform acceleration of turbulent eddies through the stagnation point flow. It is shown that the corotating vortex pair can be excited or de-excited by an externally applied sound field. The model is used to qualitatively explain experimental results on excited jets. Author

N78-22862# Pennsylvania State Univ., University Park. Applied Research Lab.

ON THE DIFFRACTION OF PLANE ACOUSTIC WAVES BY AN ELLIPSOIDALLY CAPPED ELASTIC CYLINDER OF ARBITRARY IMPEDANCE Final Report

F. H. Fenlon 17 Nov. 1977 40 p refs (Contract N00017-73-C-1418)

(AD-A050892; TM-77-314) Avail: NTIS HC A03/MF A01 CSCL 20/1

In this paper, the Geometrical Theory of Diffraction is used to investigate the effect of diffraction on the back response of transducer array elements mounted on the flat face of an ellipsoidally capped cylinder of arbitrary acoustic impedance. Author (GRA)

N78-22863# Scripps Institution of Oceanography, San Diego, Calif.

A COMPARISON BETWEEN ACOUSTIC REVERBERATION STRUCTURES AT 87.5 KHz AND INTERNAL WAVES Final Report

G. T. Kaye 17 Oct. 1977 37 p refs (Contract N00014-75-C-0749; Contract ARPA Order 2127)

(AD-A050961; MPL-U-85/77; SIO-REF-77-24) Avail: NTIS HC A03/MF A01 CSCL 20/1

Reverberation data at 87.5 kHz were obtained with a narrow-beam echo sounder from R/P FLIP in January and June 1977 off southern California. Analysis of these data shows that backscattering below the wind-mixed layer was due primarily to discrete point scatterers, which had target strengths ranging from -38 to -73 db and densities of 0.05 to 50 individuals per 1000 cu m. Based upon these characteristics, the identities of the scatterers are probably swimbladder fish, and possibly squid and siphonophores. Backscattering from smaller organisms has been observed as patches or as a limited number of scattering layers. A visual comparison between scatterer motions and isotherm depth fluctuations showed excellent correlation in terms of both phase and amplitude. Minimum total wave amplitudes as small as three meters were observed. It is suggested that this depth resolution might be improved with better data processing techniques and increased system performance. Author (GRA)

N78-22864# Naval Research Lab., Washington, D. C. Large Aperture Acoustics Branch.

A CORRECTED PARABOLIC-EQUATION PROGRAM PACKAGE FOR ACOUSTIC PROPAGATION Interim Report

John S. Perkins and Ralph N. Baer Jan. 1978 27 p (RR0310341)

(AD-A050564; AD-E000114; NRL-MR-3688) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report documents a package of computer programs which solves the parabolic equation for acoustic propagation using a split-step algorithm. These programs are implemented on the Texas Instruments ASC at NRL, and make use of its pipelining and vectorizing capabilities. They include the ability to partially correct for the errors induced by the parabolic assumptions. The report contains a summary of the theory and information on how to run the programs. Author (GRA)

N78-22865# Institut Franco-Allemand de Recherches, St. Louis (France).

ACOUSTIC STIMULUS PROPAGATION IN THE INNER EAR OF THE GUINEA PIG BY RECORDING OF THE ACOUSTIC INTERCOCHLEAR PRESSURE AND THE MICROPHONE POTENTIAL [ETUDE DE LA PROPAGATION DU STIMULUS ACOUSTIQUE DANS L'OREILLE INTERNE DU COBAYE PAR ENREGISTREMENT DE LA PRESSION ACOUSTIQUE INTRACOCHLEAIRE ET DU POTENTIEL MICROPHONIQUE]

A. Dancer and R. Franke 25 Jul. 1977 14 p refs In FRENCH Presented at the 9th Intern. Congr. on Acoust., Madrid, 4-12 Jul. 1977

(ISL-CO-212/77) Avail: NTIS HC A02/MF A01

Intercochlear pressure variations during exposure to pure sound and to impulse noise were studied in the guinea pig in order to determine the injury threshold. Experimental results are discussed and compared with those of other authors. ESA

N78-22866# Institut Franco-Allemand de Recherches, St. Louis (France).

INVESTIGATION OF THE COCHLEAR POTENTIALS IN THE GUINEA PIG PRODUCED BY BRIEF SHOT NOISE [ETUDE CHEZ LE COBAYE DES POTENTIELS COCHLEAIRES ENGENDRES PAR DES BRUITS TRANSITOIRES BREFS]

A. Dancer, R. Franke, J. Dulchain, and G. Evrard 30 Mar. 1977 72 p refs In FRENCH

(ISL-R-104/77) Avail: NTIS HC A04/MF A01

Investigation of the microphonic cochlear potential in a guinea pig exposed to brief impulse noise has provided no proof for the delay in the propagated wave. This is contrary to observations carried out for pure tone stimuli. Problems related to the propagation of the mechanical stimulus within the cochlea, and problems concerned with shot noise effects leading to injuries, are discussed. ESA

N78-22867# Institut Franco-Allemand de Recherches, St. Louis (France).

METABOLIC VARIABLES IN THE MINIATURE PIG: INTERSEXUAL COMPARISON, EFFECTS OF AN ANESTHETIC. EFFECTS OF IMPULSE NOISE ON THE BLOOD VARIABLES IN THE FEMALE MINIATURE PIG [ETUDE DES VARIABLES METABOLIQUES CHEZ LE PORC NAIN. 1. COMPARAISON INTERSEXUELLE, EFFETS D'UN ANESTHESIQUE. 2. EFFETS DES BRUITS IMPULSIFS DE TYPE BRUIT D'ARME SUR LES VARIABLES SANGUINES DU PORC NAIN FEMELLE]

P. Vassout and F. Devriere 31 May 1977 34 p refs In FRENCH Original contains color illustrations

(ISL-R-107/77) Avail: NTIS HC A03/MF A01

The basic values of several metabolic products in blood and plasma, and the basic values of the hypophysical and suprarenal hormones, were determined in the anesthesized or non-anesthesized miniature pig as a function of sex. The effects of the peak overpressure of a gunshot produced in the free field were investigated. Results show that the amplitude of hormonal changes depends on the peak overpressure, and that hormonal changes lead to variations in the magnitude of various metabolic products. The miniature pig appears to be well adapted to study acoustic effects since it is physiologically similar to the human being and it allows applying non-traumatizing methods for sample extraction and injections. ESA

N78-23038# European Space Agency, Paris (France).

METROLOGY OF AIRCRAFT OVERFLIGHT NOISE. ERRORS DUE TO ITS NONSTATIONARY CHARACTER

Max Ernoult *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 66-86 refs Transl. into ENGLISH from La Rech Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 245-254 Original report in FRENCH previously announced as A77-50441 (For availability see N78-23033 13-99)

Avail: NTIS HC A05/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-22868 Stanford Univ., Calif.
POLARIZATION SPECTROSCOPY AND THE MEASUREMENT OF THE LAMB SHIFT IN THE GROUND STATE OF HYDROGEN Ph.D. Thesis
Carl Edwin Wieman 1977 120 p
Avail: Univ. Microfilms Order No. 78-02255

The Lamb shifts of the ground state of hydrogen and deuterium were measured using nonlinear laser spectroscopy. The measured values are 8161.0 + or - 29 MHz for hydrogen and 8183.1 + or - 29 MHz for deuterium, which are in excellent agreement with the theoretical results. The Lyman-alpha isotope shift between hydrogen and deuterium was also measured, giving a value of 67099.3 + or - MHz. This gives the first experimental confirmation of the relativistic nuclear recoil contribution to hydrogenic energy levels. The technique of polarization spectroscopy uses two counterpropagating laser beams in a gas sample. The first beam, circularly polarized to create an optical anisotropy, can be very sensitively detected by observing its effect on the linear polarization of the second beam. Because the beams are counterpropagating the interactions between them are Doppler-free. Dissert. Abstr.

N78-22869 Pittsburgh Univ., Pa.
RAYLEIGH SCATTERING, ELASTIC PHOTON SCATTERING BY BOUND ELECTRONS Ph.D. Thesis
Lynn David Kissel 1977 164 p
Avail: Univ. Microfilms Order No. 78-01866

The direct numerical evaluation of the second order S matrix is the basis for predicting photon scattering due to bound atomic electrons. Predictions are valid for all shells of all isolated atoms for photon energies 1 keV through 10 MeV. The circumstances for which the form factor approximation and the modified form factor approximation will yield useful predictions for the Rayleigh scattering amplitudes for a given shell and the total atom are summarized. Effects of screening (choice of potential) and relativistic effects are discussed. A prescription for the accurate (O(5%)) prediction of the Rayleigh amplitudes for this photon energy range is described and sample tabulations of the differential scattering amplitudes are presented. These predictions for the Rayleigh amplitudes are used to investigate discrepancies between previous theory and experiment which occur for medium to heavy elements for photon energies 1-10 MeV and 10-100 keV. Dissert. Abstr.

N78-22870 Denver Univ., Colo.
LYMAN ALPHA EMISSION FROM PROTON-SURFACE COLLISIONS Ph.D. Thesis
Yu-yuan Roger Hsiao 1977 170 p
Avail: Univ. Microfilms Order No. 78-01399

A 0.3 meter vacuum monochromator was used to observe Lyman-alpha emission from polycrystalline Mo, Ta, Pt and Cu and from single crystal n-type Ge and Si surfaces under 6.5 to 12.5 keV proton bombardment. The viewing direction was fixed at 60 deg relative to the proton beam axis. The absolute photon yield was determined as a function of beam-surface incidence angle and surface temperature. Doppler shift profiles of Lyman-alpha emission were used to determine the backscattered, excited hydrogen atom energies. The results are discussed within the framework of existing models of ion-surface interactions including large-angle proton backscattering from lattice atoms and electron capture at its outward surface exit. In addition to the photon yield measurements, secondary negative charge emission coefficient measurements are also reported. Dissert. Abstr.

N78-22871 California Univ., San Diego.
ATOMIC COLLISIONS AT INTERMEDIATE ENERGIES Ph.D. Thesis
Yim Tin Lee 1977 122 p
Avail: Univ. Microfilms Order No. 77-32816

The effect of the distortion of the target by the incident particle on the differential cross section at the forward direction was investigated using the closure approximation and semiclassical eikonal approximation. Differential cross sections for elastic scattering of electrons by hydrogen and helium atoms in the energy region 30 eV to 200 eV were calculated. Born approximation was used to calculate the transition amplitude in determining the angular distribution of the neutral atomic hydrogen beam produced through collisional electron detachment of H (-) ions by He, H, and H2 targets in the keV-meV energy region. The effect of the target distortion on the process H(-) + M yields H+e+M for the production of H atoms was also studied. Dissert. Abstr.

N78-22872 California Univ., Los Angeles.
SPACE CHARGE EFFECTS IN ION BEAMS Ph.D. Thesis
James Terry Crow 1977 91 p
Avail: Univ. Microfilms Order No. 78-02592

A model of a monoenergetic beam is presented in which neutralization is achieved in one or more of three ways: (1) electrons are injected into the beam and are trapped, (2) electrons injected into the beam create a plasma by ionization of neutrals by beam ions. In this model, degradation of beam propagation was due to electric fields in the sheath region at the beam edges, and so the outer surfaces of the beam peel off, leaving the center at a constant density (neglecting collisions). This contrasted with the usual calculation of uniform expansion of an unneutralized beam. A calculation was made of beam parameters under the assumption of exact space charge neutrality. Slow ion loss current was derived, and particle balance calculations in the three cases provide the beam potential with respect to the walls. Dissert. Abstr.

N78-22873 Illinois Univ., Urbana-Champaign.
THEORETICAL STUDY OF ION BUNCHING FOR PELLET FUSION IN SELF-CONSISTENT TIME DEPENDENT SPACE CHARGE FIELDS Ph.D. Thesis
Po-Chiang Lu 1977 86 p
Avail: Univ. Microfilms Order No. 78-04078

The use of intense ion beams as a heating source for the fusion reaction in pellets of D-T appears to have several potential advantages over the use of electron beams. If ion bunching can be accomplished, then existing technology can be used to achieve the required power, energy and time scales for pellet fusion. A scheme to be considered is that of a pre-formed nonuniform plasma adjacent to a partially transparent anode through which a space charge limited electron beam is injected from the terminals of a convergent spherical geometry with a finite rise-time. At the instant of beam injection, the virtual cathode is formed. Due to the space charge fields set up by the beam, the plasma ions are accelerated towards the region beyond the virtual cathode. Using that scheme one can bunch the arrival of the accelerated ions at a target. Dissert. Abstr.

N78-22874# Polytechnic Inst. of New York, Brooklyn. Dept. of Physics.
COMPTON SCATTERING FROM ATOMS Annual Report
Lawrence B. Mendelsohn and Vedene Smith Mar. 1977 38 p refs
(Contract N00014-75-C-0475)
(AD-A050743) Avail: NTIS HC A03/MF A01 CSCL 20/8

Chapter 5 in COMPTON SCATTERING (McGraw Hill, 1977) covers: Impulse Approximation; Momentum Distributions and Impulse Compton Profiles; Calculations of Impulse Compton Profiles for One Electron Models; Electron Correlation and Impulse Compton Profiles; Relativistic Profile Corrections; Comparison of Theory and Experiment for Free Atoms. Author (GRA)

N78-22875# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
INELASTIC MOLECULAR COLLISIONS: APPLICATIONS OF THEORETICAL METHODS TO PROBLEMS IN RELAXATION PHENOMENA AND LASER OPERATION Progress Report, 1 Feb. - 1 Nov. 1977
R. W. Conn 1977 11 p refs
(Contract EY-76-S-02-2555)
(COO-2555-1) Avail: NTIS HC A02/MF A01

Practical theoretical methods for handling molecular collision problems were developed and implemented in order to study the important processes which influence collision rates and compute rate information suitable for gas laser modeling studies.

Particular emphasis is focused on the CO and HF molecules, which are of practical interest as molecular lasers and of theoretical interest discerning the role of rotation processes in vibrational relaxation. Progress is reported in implementing the operator decomposition and related unitary approaches as practical computation schemes. ERA

N78-22876# California Univ., Berkeley. Lawrence Berkeley Lab.
LONG RANGE IMAGINARY OPTICAL POTENTIAL IN ELASTIC SCATTERING
A. J. Baltz, S. K. Kauffmann, N. K. Glendenning, and K. Pruess 30 Sep. 1977 35 p refs Presented at the Symp. on Nucl. Direct Reaction Mechanism, Tokyo, 5-10 Sep. 1977
(Contract W-7405-eng-48)
(LBL-6588; Conf-770968-5) Avail: NTIS HC A03/MF A01

The long range imaginary optical potential arising from quadrupole Coulomb excitation is derived in closed form. An analytical closed form for elastic scattering is obtained by inserting this potential into a weak absorption modified form of Frahn's strong absorption model. ERA

N78-22877# Rensselaer Polytechnic Inst., Troy, N. Y.
THEORY OF HEAVY ION COLLISIONS Annual Progress Report
Daniel Sperber Aug. 1977 11 p refs
(Contract EY-76-S-02-3463)
(COO-3463-32) Avail: NTIS HC A02/MF A01

These investigations concerned themselves mainly with the study of collisions between very heavy ions where there was little or no fusion. For these reactions the reaction cross section was exhausted by the strongly damped processes. Models for collision between light ions, where fusion plays an important role, were investigated. The dynamics were improved by introducing collective degrees of freedom which absorb energy from the relative motion. The dependence of the inertias, potentials and friction on these degrees of freedom and the corresponding velocities, are calculated from first principles. ERA

N78-22878# California Univ., Livermore. Lawrence Livermore Lab.
EMITTANCE AND TRANSPORT OF INTENSE HOLLOW ELECTRON BEAMS
V. K. Neil 28 Nov. 1977 11 p refs
(Contracts W-7405-eng-48; N00024-77-MP-7120M)
(UCID-17670) Avail: NTIS HC A02/MF A01

High current (I approximately 10 kA) hollow beams of relativistic electrons may be created and transported only if an axial magnetic field of the order of 1 tesla is present at the emitting surface. The magnetic field imparts canonical angular momentum to the particles. The canonical angular momentum is a constant of the motion in azimuthally symmetric systems, and if the beam is extracted from the magnetic field, it acts as an effective emittance. It is shown that this emittance can be so large as to render impossible the transport of the beam in self-pinched equilibrium with a radius of the order of a few cm. ERA

N78-22879# Unilever Research, Vlaardingen (Netherlands).
INFRARED SPECTROSCOPY OF ADSORBED MOLECULES AND ITS PRACTICAL ASPECTS
J. Erkelens [1977] 27 p refs Submitted for publication
Avail: NTIS HC A03/MF A01

Spectra of absorbed molecules are usually studied by means of pressed disks of the adsorbent; an aluminum ring around the pellet of the die greatly facilitates the pressing. To eliminate undesired scattering of the radiation the particle size of the adsorbent must be either small or large with respect to the wave-length. A formula for the absorption of radiation was applied to a silica-supported nickel catalyst. To obtain maximum interaction of radiation with the nickel particles of the catalyst, they must be smaller than 10 nm. The influence of the slit-width on an absorption band was simulated and it was found that it should be at least five times smaller than the observed half-width. Heating of the adsorbent in the infrared beam, as well as emission of radiation from it, may cause uncertainties in the interpretation of the results. The type of cell should be chosen to suit the problem to be studied. Author (ESA)

N78-22880# Montpellier Univ. (France). Dept. de Physique Mathematique.
PHENOMENOLOGY OF NEW PARTICLES
F. M. Renard 1977 33 p refs Presented at the France-Japan Joint Seminar on New Particles and Neutral Weak Currents, Tokyo, 14-17 Jul. 1977
(PM/77/5) Avail: NTIS HC A03/MF A01

The properties of charmonium spectroscopy are reviewed with regard to nonrelativistic charmonium potentials, level splitting, allowed transitions, and annihilation into photons and into gluons. The forbidden transitions and the Iizuka-Okubo-Zweig rule are discussed. The spectroscopy of charmed mesons is analyzed taking into consideration electromagnetic mass differences, strong and e-m decays conserving charm, weak decays which are charm changing, D zero and D zero bar mixing, and electron positron annihilation above the new thresholds. A list of experimental measurements that would be useful in solving existing problems and in checking more deeply the present day description of new particles is given. ESA

N78-22881# Montpellier Univ. (France). Dept. de Physique Mathematique.
THEORETICAL ASPECTS OF LEPTON PRODUCTION IN HADRONIC COLLISIONS [ASPECTS THEORIQUES DE LA PRODUCTION DE LEPTONS DANS LES COLLISIONS HADRONIQUES]
F. M. Renard Sep. 1977 24 p refs In FRENCH Conf. held at the Summer School 'Phys. de Particules', Gif-sur-Yvette, France, Sep. 1977
(PM/77/7) Avail: NTIS HC A02/MF A01

The Drell-Yang model for the production of lepton pairs is discussed with regard to its qualitative properties and relation to the functions structuring the lepton inelastic scattering. Theory is compared with experiment, and the modifications to the theory that resulted are discussed. The contribution of vector mesons and mother-daughter relationships are used to deduce lepton spectra. Other sources of leptons such as Dalitz pairs, Bremsstrahlung, charmed particles, heavy leptons, and weak bosons are dealt with. ESA

N78-22656 Wuerzburg Univ. (West Germany). Inst. fuer Medizinische Strahlenkunde.
MICRODOSIMETRIC CONCEPTS RELEVANT TO HZE-PARTICLES
A. M. Kellerer *In* ESA Life-Sci. Res. in Space Sep. 1977 p 271-277 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

N78-22658 Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Inst. fuer Kernphysik.
METHODS OF MICRODOSIMETRY IN (SPACE) RADIATION BIOLOGY
E. Schopper and J. U. Schott (DFVLR, Cologne) *In* ESA Life-Sci. Res. in Space Sep. 1977 p 285-288 refs Sponsored by Min. of Res. and Technol. (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N78-22882 California Univ., Irvine.
METHODS OF COLLECTIVE ION ACCELERATION Ph.D. Thesis
Ardeshir Aspy Irani 1976 188 p
Avail: Univ. Microfilms Order No. 78-01123

A theoretical model was developed to explain observations of collective ion acceleration in linear systems. A linearized calculation for the pinch mechanism considered is carried out using the two mass approximation for the relativistic electron beam. This model differs from the picture previously constructed in that the polarization charge due to Cerenkov plasma wave

emission by the ion bunch is also considered. Polarization and subsequent pinching of the electron beam takes place and the ion bunch is accelerated due to electrostatic fields invoived in the pinch configuration. As the ions accelerate, the entire configuration moves self-synchronized with the ion bunch. Experimental results are discussed. Dissert. Abstr.

N78-22883 Columbia Univ., New York.
A STUDY OF THE DISSIPATIVE TRAPPED ELECTRON INSTABILITY USING FEEDBACK AND ION HEATING Ph.D. Thesis
David Phelps Dixon 1977 107 p
Avail: Univ. Microfilms Order No. 78-04358

Dissipative trapped electron instability was studied in a linear geometry. By varying the length of the magnetic mirror cell, the axial wavenumber of the mode is determined by the localization of the instability in the region between the two magnetic mirrors. The axial wavenumber in turn affects the real frequency. A feedback diagnostic was developed and used to provide measurements of the instability growth rate, as well as to provide evidence of the dissipative nature of the mode. In order to enhance the effects of finite Landau radius, an ion cyclotron resonance scheme was observed to become important when the ions are heated and when the cell length is short. Dissert. Abstr.

N78-22884*# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
GAS CORE REACTORS FOR ACTINIDE TRANSMUTATION AND BREEDER APPLICATIONS Annual Report
J. D. Clement and J. H. Rust 1 Apr. 1978 128 p refs
(Grant NsG-1288)
(NASA-CR-156179) Avail: NTIS HC A07/MF A01 CSCL 18K

This work consists of design power plant studies for four types of reactor systems: uranium plasma core breeder, uranium plasma core actinide transmuter, UF6 breeder and UF6 actinide transmuter. The plasma core systems can be coupled to MHD generators to obtain high efficiency electrical power generation. A 1074 MWt UF6 breeder reactor was designed with a breeding ratio of 1.002 to guard against diversion of fuel. Using molten salt technology and a superheated steam cycle, an efficiency of 39.2% was obtained for the plant and the U233 inventory in the core and heat exchangers was limited to 105 Kg. It was found that the UF6 reactor can produce high fluxes (10 to the 14th power n/sq cm-sec) necessary for efficient burnup of actinide. However, the buildup of fissile isotopes posed severe heat transfer problems. Therefore, the flux in the actinide region must be decreased with time. Consequently, only beginning-of-life conditions were considered for the power plant design. A 577 MWt UF6 actinide transmutation reactor power plant was designed to operate with 39.3% efficiency and 102 Kg of U233 in the core and heat exchanger for beginning-of-life conditions.
Author

N78-22885# Research Inst. of National Defence, Stockholm (Sweden).
NEUTRON- AND GAMMA-RAY TRANSPORT CALCULATIONS OF DOSE TRANSMISSION FACTORS IN CONCRETE
Goesta Engstroem and Tomas Lefvert Aug. 1977 59 p refs
(FOA-C-20195-A2) Avail: NTIS HC A04/MF A01

A series of neutron- and gamma-ray dose transmission calculations was performed for concrete infinite slabs with thickness up to 1.5 m. The calculations being of the adjoint type, indicates that the results can be used to find the transmitted gamma-ray dose from arbitrary incident gamma-ray sources as well as the transmitted neutron- and secondary gamma-ray dose from any incident neutron source distribution. Three sets of transmission factors are given: one for the gamma-ray dose, one for the neutron- plus secondary gamma-ray dose, and one for the neutron dose only. A small retrieval and folding program is also described. The program reads the data tables and the user's source information, performs the folding, and, if necessary, interpolates in slab thickness. Author (ESA)

N78-22886# Montpellier Univ. (France). Dept. de Physique Mathematique.
PHYSICAL EXPERIMENTS ASSOCIATED WITH LARGE STORAGE RING PROJECTS ELECTRON-POSITRON AND ELECTRON PROTON [LA PHYSIQUE ASSOCIEE AUX GRANDS PROJETS D'ANNEAUX E+E- ET EP]
F. M. Renard Sep. 1977 23 p refs In FRENCH Conf. held at the Summer School 'Phys. de Particules', Gif-sur-Yvette, France, Sep. 1977
(PM/77/8) Avail: NTIS HC A02/MF A01

Experiments made possible by the large storage ring projects under development are reviewed. Neutral currents and Z sub zero quest is discussed together with production of W charged bosons or Higgs bosons and of heavy leptons. Tests of quantum electrodynamics and weak interactions together with photon-photon interactions are detailed. Electron positron annihilation into hadrons are outlined. ESA

N78-23025*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONTROL SYSTEM STUDIES FOR THERMIONIC REACTORS
Richard J. Hermsen (Calif. State Polytech. Univ., Pomona) and Henrik G. Gronroos *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 337-364 refs (For availability see N78-23010 13-99)
(Contract NAS7-100)
Avail: NTIS HC A22/MF A01 CSCL 20C

74 OPTICS

Includes light phenomena.

N78-22887 Illinois Univ., Urbana-Champaign.
UNIFORM SOLUTION FOR THE FIELD DIFFRACTED BY A CURVATURE DISCONTINUITY IN A CYLINDER Ph.D. Thesis
Thomas Paul Fontana 1977 206 p
Avail: Univ. Microfilms Order No. 78-03989

The discontinuity compensating method (DCM) provides a uniform diffracted field to add to the geometrical optics (GO) field scattered by a cylindrical surface, with discontinuous curvature along a line O. For such problems, the GO field is discontinuous across a sheet composed of rays reflected from O. The DCM technique associates compensating currents with such discontinuities. The field radiated by these currents is the diffracted field and is highly directional so that only the region about O affects the field distribution. For this reason, the scattering surface may be approximated by a plane for the purpose of calculating the diffracted fields. Then an integral expression for the diffracted field can be constructed. The validity of this approximation has been examined by testing the boundary conditions on the original scatterer. Dissert. Abstr.

N78-22888 Michigan Univ., Ann Arbor.
OPTICAL PROPAGATION IN PERIODIC MEDIUM: THEORY AND APPLICATION Ph.D. Thesis
Wen-yuan Wang 1977 165 p
Avail: Univ. Microfilms Order No. 7804836

Topics discussed include: (1) extension of the thin grating decomposition (TGD) method to the analysis of optical propagation in reflection gratings, (2) analysis of third order Bragg diffraction in a periodic medium; (3) the properties of interferometric waveguide; (4) combination of the geometrical optics concept and the diffraction approach to analyze the optical propagation in waveguide couplers, distributed feedback lasers and distributed Bragg reflector lasers. A geometrical optics approach to the analysis of holographically produced waveguide gratings is presented. Dissert. Abstr.

N78-22889 Johns Hopkins Univ., Baltimore, Md.
EXPERIMENTAL PERFORMANCE OF POINT PROCESS ESTIMATORS OF OPTICAL PULSE DELAY Ph.D. Thesis
Larry Marion Stephens 1978 138 p
Avail: Univ. Microfilms Order No. 7806276

The problem of estimating the time delay of an optical pulse was examined based on the non-deterministic occurrence times of photoelectrons emitted from a direct detection photoelectric-effect receiver. Both the minimum mean square error (MMSE) and maximum likelihood estimation techniques are employed.

Closed form solutions to this problem become intractable or inapplicable in the presence of photocounts caused by sources other than the signal pulse. Maximum likelihood (ML) estimation was examined for the case of a Gaussian optical pulse; it was found that ML estimation is entirely equivalent to MMSE estimation when background noise is absent. In the presence of background noise, ML estimation was found experimentally to provide estimates which agree with MMSE estimation but evaluation of the performance of ML estimates is more difficult than that of the MMSE estimates. Dissert. Abstr.

N78-22890*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MULTISPECTRAL IMAGING AND ANALYSIS SYSTEM Patent Application
Alexander F. H. Goetz (JPL) and Frederick P. Landauer, Jr., inventors (to NASA) (JPL) Filed 5 Mar. 1976 15 p
(Contract NAS7-100)
(NASA-Case-NPO-13691-1; US-Patent-Appl-SN-664091) Avail: NTIS HC A02/MF A01 CSCL 20F

The invention concerns a system for collecting and processing in real time incident spectral reflectance data while the system is airborne. The novelty of the present invention appears to reside in the capability of having spectral reflectance data collected and analyzed in real time aboard an airborne craft. Such capability is not only more economical from the standpoint of data processing; but further, and perhaps more importantly, eliminates the common delay of several months between collection of the data and analysis thereof. Hence, the subject invention permits data analysis to be timely as well as prompt. The importance of such capability is exemplified by the potential use of the invention for detecting oil spills or algal growth wherein prompt analysis of the spectral reflectance data permits quick indentification and a solution to be promptly implemented. NASA

N78-22891*# National Aeronautics and Space Administration. Pasadena Office, Calif.
VELOCITY SERVO FOR CONTINUOUS SCAN FOURIER INTERFERENCE SPECTROMETER Patent Application
Rudolf A. Schindler, inventor (to NASA) (JPL) Filed 24 Feb. 1978 12 p
(Contract NAS7-100)
(NASA-Case-NPO-14093-1; US-Patent-Appl-SN-880729) Avail: NTIS HC A02/MF A01 CSCL 20F

The invention relates to interferometers utilizing double-pass retroreflectors, and more particularly to an improvement in a continuous scan interferometer using an open-loop lead-screw drive system. The novelty of the invention resides in the arrangement for driving the lead screw in an open loop, and in providing reference fringe detection for the purpose of producing a compensation signal for any deviation of the actual scan rate from a desired scan rate. NASA

N78-22892*# Perkin-Elmer Corp., Norwalk, Conn.
SPUTTER METALIZATION OF WOLTER TYPE OPTICAL ELEMENTS Final Report, Jun. 1976 - Jun. 1977
Anthony M. Ledger Aug. 1977 43 p refs
(Contract NAS5-23581)
(NASA-CR-156754; Rept-13437) Avail: NTIS HC A03/MF A01 CSCL 20F

An analytical task showed that the coating thickness distribution for both internal and external optical elements coated using either electron beam or sputter sources can be made uniform and will not affect the surface figure of coated elements. Also, sputtered samples of nickel, molybdenum, iridium and ruthenium deposited onto both hot and cold substrates showed excellent adhesion. Author

N78-22893# Electrotechnical Lab., Tokyo (Japan).
RESEARCHES ON COLOR MATCHING FUNCTIONS
Kanji Katori, Masahiro Fuwa, and Yoshio Sugiyama Dec. 1977 117 p refs In JAPANESE; ENGLISH summary
(Rept-773) Avail: NTIS HC A06/MF A01

The color matching functions for 10 deg field, which were adopted as the CIE 1964 supplementary standard colorimetric observer, are based on the mean values obtained with Western observers, and pose various important problems, such as the additivity of color matching in the large field, and the effect of color adaptation to visual field on the color matching. A colorimeter, in which an automatic control technique was applied to color measurement, was constructed and used measurement color matching functions in the Japanese subjects and by the method of constant stimuli analysis of the color adaptation effect on persistence of color matching. The dependency of color matching functions on the retinal illuminance of visual field is examined. In order to investigate causes of the differences between the data obtained and the CIE data. Author

N78-22894# Texas Technological Univ., Lubbock. Optical Systems Lab.
SPACE-VARIANT COHERENT OPTICAL PROCESSING Interim Report
Robert J. Marks, II and Marion O. Hagler 1 Dec. 1977 220 p refs
(Grant AF-AFOSR-0212-78)
(AD-A050973; SR-1; AFOSR-78-0212TR) Avail: NTIS HC A10/MF A01 CSCL 20/6

This report describes various techniques for performing linear, space-variant operations with coherent optical processors. Both theoretical and experimental results are presented. Generalized one dimensional space-variant processors capable of performing a broad class of superposition integral operations are presented. Applications including integral transform evaluation and ambiguity function display are presented. Two-dimensional space-variant processors are also discussed, with several approaches being discussed. Author (GRA)

N78-22895# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
PROTOTYPE AUTOMATIC TARGET SCREENER Quarterly Progress Report, 21 Sep. - 31 Dec. 1977
D. E. Soland, P. M. Narendra, R. C. Fitch, and D. P. Panda 15 Jan. 1978 143 p refs
(Contract DAAK70-77-C-0248; DA Proj. 1E2-63710-DK-70)
(AD-A050684; HONEYWELL-78SRC6) Avail: NTIS HC A07/MF A01 CSCL 17/5

This report is the first quarterly progress report on the Prototype Automatic Target Screener. The objective of the effort is an automatic target screener to be used with thermal imaging systems employing common module components. GRA

N78-22896# Suntech, Inc., Marcus Hook, Pa.
INFRARED SPECTRA OF FLUID FILMS UNDER CONDITIONS OF INCIPIENT BEARING FAILURE Final Report
James E. Lauer 20 Dec. 1977 114 p refs
(Contract F49620-76-C-0042; F44620-74-C-0038)
(AD-A050604; AFOSR-78-0190TR) Avail: NTIS HC A06/MF A01 CSCL 11/8

Emission spectra were obtained from our operating E.H.D. contacts through a diamond window, using a specially built Fourier Infrared Emission Microinterferometer. These spectra were compared with similar static spectra obtained in a high-pressure diamond anvil cell. As an example, 5P4E, polyphenyl ether fluid is discussed in detail. Changes in the spectrum with pressure and temperature under static conditions allow inferences on these parameters under various dynamic conditions. The dynamic spectra differ markedly under polarization, an indication of molecular alignment. Author (GRA)

N78-22897# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN OPTICAL DISC RECORDER Final Technical Report, 1 Oct. 1975 - 1 Oct. 1977
George Kenny, D. Lou, J. Wagner, F. Zernike, and R. McFarlane Jan. 1978 94 p refs
(Contract N00014-76-C-0441; DARPA Order 0380)
(AD-A050784) Avail: NTIS HC A05/MF A01 CSCL 20/6

A laboratory-prototype, digital, optical disc recorder was developed with a storage capacity of 10 to the 10th power bits. Recording is done by laser machining of micron-sized pits in a thin tellurium film allowing direct-read-after-write (DRAW) of the information. The recording format maps each bit of information to a recorded pit. The tellurium is deposited on a clear plastic disc configured to be self-protecting and easily handled. The major accomplishment was demonstrating the feasibility of an inexpensive recorder and disc suitable for operation in a normal office environment. The key developments were a

sensitive recording material, a plastic disc, and a self-protected disc configuration called the 'air sandwich'. Various materials were considered for the disc substrate and its protection; selection was based primarily on macro and microscopic flatness, thickness uniformity, strength, optical properties, adherence of DRAW film, and cost. GRA

N78-22898# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
AN OPTICAL PARTICLE-SIZING COUNTER FOR IN-SITU MEASUREMENTS
Don Holve (Stanford Univ., Calif.) and Sidney A. Self (Stanford Univ., Calif.) Jan. 1978 70 p refs
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A050757; SQUID-SU-2-PU) Avail: NTIS HC A04/MF A01 CSCL 17/8

A particle sizing counter is described, suitable for in-situ measurements in two phase flows of laboratory scale. It employs near-forward scatter from the focus of a He-Ne laser beam, together with pulse height-analysis of the signals from individual particles. A novel and essential feature of the technique is a numerical inversion scheme to unfold the dependence of the scattered signals on particle trajectory through the measurement volume. The inversion procedure is performed by an on-line computer, and utilizes a prior calibration with monodisperse aerosols of known size. GRA

N78-22899# United Technologies Research Center, East Hartford, Conn.
OPTICAL SYSTEM FOR DYNAMIC ANALYSIS OF ROTATING STRUCTURES Final Technical Report, 20 Jan. 1975 - 20 Jan. 1977
K. A. Stetson and J. N. Elkins Wright-Patterson AFB, Ohio AFAPL Oct. 1977 113 p refs
(Contract F33615-75-C-2013; AF Proj. 3066)
(AD-A050758; UTRC/R77-992054) Avail: NTIS HC A06/MF A01 CSCL 20/6

It has been demonstrated that interferometric holograms can be recorded, of objects rotating at high speeds, in a manner sufficiently practical to permit test stand application. This was shown with the successful pictorial acquisition of the vibration characteristics of a TS22 fan stage, operated at speeds up to approximately 8000 rpm, at an outdoor Pratt and Whitney Aircraft test facility located near Bradley Field. The theoretical and experimental work leading up to, and including, these tests was performed during a two-year study, which is reviewed herein. The work included: (1) a design study to Select a practical image derotation scheme; (2) development of the hardware to complement the chosen method; (3) laboratory tests of the system to illustrate its application to the optical analysis of rotating structures; (4) consideration of the modifications and additions required for adaptation to an actual test stand environment; (5) design, fabrication, and assembly of hardware suitable for test stand installation; and (6) evaluation of the system at a Pratt and Whitney Aircraft test facility. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-22900 California Inst. of Tech., Pasadena.
RESONANCE CONES AND MODE CONVERSION IN A WARM MAGNETIZED BOUNDED PLASMA Ph.D. Thesis
Crookett Lane Grabbe 1978 204 p
Avail: Univ. Microfilms Order No. 7801531

The warm plasma resonance cone structure of the quasistatic field produced by a gap source in a bounded magnetized slab plasma is determined for a homogeneous or mildly inhomogeneous plasma with source frequency lying between the lower hybrid frequency and the plasma frequency as well as for the complicated case of an inhomogeneous plasma with two internal lower hybrid layers present, which is of interest to radio frequency heating of plasmas. Energy theorems for quasistatic fields are developed and applied to determine the power flow and absorption along the individual cones. Thus, the points of concentration of the flow and the various absorption mechanisms are revealed. Dissert. Abstr.

N78-22901 California Univ., San Diego.
DESTRUCTION OF TRAPPED PARTICLE OSCILLATIONS Ph.D. Thesis
Guy Dimonte 1977 132 p
Avail: Univ. Microfilms Order No. 77-32798

Two ways of destroying the trapping oscillations were found. The first mechanism involves the main wave only. As a result of finite dissipation in the slow wave structure, the trapping oscillations of the main wave can have very deep minima. These trigger large and rapid wave phase shifts which alter the phase relation between the trapped particles and the wave potential so as to detrap the particles. The second mechanism is a result of unstable sidebands which grow to amplitudes comparable to the main wave. These modulate the main wave to produce beat minima in which the particles become detrapped. The detrapping, induced by either method, leads to particle mixing in phase space which precludes further trapping oscillations. Dissert. Abstr.

N78-22902 Wisconsin Univ., Madison.
AMBIPOLAR ELECTRIC FIELDS AND TURBULENCE STUDIES IN THE WISCONSIN LEVITATED TOROIDAL OCTUPOLE Ph.D. Thesis
Charles Jesse Armentrout 1977 384 p
Avail: Univ. Microfilms Order No. 77-25807

The turbulence structure was measured by correlation techniques which were carefully described. In these experiments, signals were studied which are aperiodic in time and space, short lived compared to the decay times of the bulk plasma parameters, short ranged compared to the machine size, and were therefore classified as microturbulence structures. The resulting spatial and temporal correlation functions were well fitted to a Gaussian function and the associated correlation lengths or times were the half width at half maximum of the CFs. The correlation length was measured to be the ion gyro radius for the hot hydrogen plasma and somewhat less for the helium plasma. The measured correlation time was comparable to the disassembly time of such a cell from the influence of the magnetic gradient and curvature drifts. Dissert. Abstr.

N78-22903 Illinois Univ., Urbana-Champaign.
QUANTUM INTERACTION OF INFRARED PHOTONS AND PLASMAS Ph.D. Thesis
Barry Gene Grossman 1977 121 p
Avail: Univ. Microfilms Order No. 7804008

Experimental evidence has indicated that electron heating is not the predominant mechanism responsible for the phenomenon of afterglow quenching observed in all noble gases at low pressures under similar conditions. This has led to the currently held theory that photoionization of the highly excited atomic states is the primary cause of light quenching. The current work extends the understanding of this phenomenon by making quantitative predictions on the amount of light quenching as a function of laser wavelength and intensity using a photoionization based plasma model, and by presenting the results of experimental measurements made of quenching with differing values of laser wavelength and intensity. Dissert. Abstr.

N78-22904 Wisconsin Univ., Madison.
RADIO-FREQUENCY HEATING AND PROPAGATION IN TOKAMAK PLASMAS IN THE ION CYCLOTRON RANGE OF FREQUENCIES Ph.D. Thesis
Tak Kuen Mau 1977 151 p
Avail: Univ. Microfilms Order No. 7800037

The heating rate of an ion interacting with a left-hand circularly polarized electric field is determined using a single-particle formalism. The electric field, as seen by a gyrating ion, is Fourier-analyzed into a summation of harmonic components. For an ion resonating with the nth harmonic component, the heating rate is non-zero and depends on its phase with respect to the wave. For a non-resonating ion, the net heating rate is zero. This result can be extended to a Maxwellian plasma and agrees closely with the results from the Vlasov treatment. The importance of collisions is assessed by comparing its relaxation time with

that due to velocity-space diffusion. For fusion reactors, the two time scales are comparable, implying that ion heating can be quite efficient. Dissert. Abstr.

N78-22905# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PLASMA DIAGNOSTICS BY NEUTRAL BEAM PROBING
Kiyoshi Kadota, Kazuki Tsuchida, and Yoshiaki Kawasumi Jan. 1978 32 p refs
(IPPJ-320) Avail: NTIS HC A03/MF A01

A technique combining a neutral beam and spectroscopy was developed to measure the spatial electron density profile of a plasma. This neutral beam probing method utilizes the photons emitted by impact excitation of the probing lithium beam with plasma electrons. The spatial electron density distribution of the plasma was determined from the measurements of the local photon flux and beam intensity by using the excitation rate coefficient calculated from the available cross section data. The comparison of these results with those of conventional methods proves this new method is of practical use in the space-resolved measurements of plasma parameters, especially when a Langmuir probe is no longer usable. The cross sections for excitation of the Li beam in collisions with He, Ar and H2 were also measured and used to estimate the neutral lithium beam intensity. Author

N78-22906# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A LINEAR REACTOR SYSTEM WITH IMPURITY SEEDED MULTIPLE-MIRROR END PLUG
K. Hirano Jan. 1978 36 p refs
(IPPJ-321) Avail: NTIS HC A03/MF A01

Multiple-mirror end-plugged linear reactor parameters are estimated including parallel electron thermal loss. The assumed thermal conductivity in a multiple-mirror is simply 1/M2 times the classical value. Impurity seeding only at the plugs is demonstrated to be effective for increasing the energy confinement time of the plasma and consequently reducing the reactor length by more than a factor 1.5. Total length of the reactor is optimized along with plasma temperature, plug length, and seeding fraction of the impurity. A typical reactor length for B = 100 kG and Q sub E = 2 is calculated to be about 1100 m with an output power of 13 GW. It is proposed to attach a magnetic bubble made of a high order multipole or SURMAC field to the end of the system. Transient low plasma and the bubble may well improve thermal insulation of the plasma and the bubble may be effective for pulsed linear systems. The necessary volume of such a bubble for a pulsed fusion ractor of N tau sub E = 5 x 10 to the 14th power/cu cm and T = 5000 eV is estimated to be 45 cu m. Author

N78-22907# Nagoya Univ. (Japan). Inst. of Plasma Physics.
HEATING OF CHARGED PARTICLES BY ELECTROSTATIC WAVE PROPAGATING PERPENDICULARLY TO UNIFORM MAGNETIC FIELD
Keishiro Niu and Takashi Shimojo Feb. 1978 18 p refs
(IPPJ-323) Avail: NTIS HC A02/MF A01

The increase in the kinetic energy of a charged particle, affected by an electrostatic wave propagating perpendicularly to a uniform magnetic field, is obtained for both the initial and later stages. Detrapping time of the particle from the potential dent of the electrostatic wave and energy increase during trapping of the particle is analytically derived. Numerical simulations are carried out to support theoretical results. Author

N78-22908# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONLINEAR CALCULATION OF THE m=1 INTERNAL KINK INSTABILITY IN CURRENT CARRYING STELLARATORS
M. Wakatani Feb. 1978 27 p refs
(IPPJ-324) Avail: NTIS HC A03/MF A01

Nonlinear properties of the m=1 internal kink mode are shown in a low beta current carrying stellarator. The effects of the external helical magnetic fields are considered through a rotational transform and the magnetic surface is assumed to be circular. Magnetic surfaces inside the iota sub eta + iota sub sigma = 1 surface shift and deform non-circularly, while magnetic surfaces outside the iota sub eta + iota sub sigma = 1 are not disturbed, where iota sub eta is a rotational transform due to helical magnetic fields and iota sub sigma is due to a plasma current. Many higher harmonics are excited after the fundamental mode saturates. When the external helical magnetic fields are lowered, the m=1 tearing mode similar to that in a low beta Tokamak grows and magnetic islands appear near the iota sub eta + iota sub sigma = 1 surface. For adequate helical magnetic fields, the current carrying stellarator becomes stable against both the m=1 internal kink mode and the m=1 internal kink mode and the m=1 tearing mode, without lowering the rotational transform. Author

N78-22909# Michigan Univ., Ann Arbor. Laser Plasma Interaction Lab.
CRITICAL LAYER PENETRATION IN A COLD Z-PINCH PLASMA BY HIGH-INTENSITY 10.6 MICRONS LASER RADIATION Ph.D. Thesis
John Goodyear Ackenhusen Sep. 1977 362 p refs
(Grant AF-AFOSR-3349-77)
(AD-A050773; LPIL-TR-100; AFOSR-78-0352TR) Avail: NTIS HC A16/MF A01 CSCL 20/9

The intensity dependence of transmission of high-intensity 10.6 microns laser radiation through an overdense cold Z-pinch plasma has been measured to determine a threshold for transmission. A holographic cinema of plasma evolution, obtained independently of the CO2 laser, provided initial information about the target plasma. An intensity threshold for transmission was measured to be about 2.5 x 10 to the 11 W/sq cm for incidence on the pre-pinch plasma, and 2 x 10 to the eleven W/sq cm for the post-pinch plasma. As the laser intensity was increased above threshold, compression of the transmitted pulse was observed from its incident width of 38 nsec to a transmitted width of 15 nsec at maximum intensity of 4 x 10 to the eleven W/cm. Coincidence measurements between the incident and transmitted pulse indicated the blockage of the first portion of the pulse and subsequent transmission of the remainder. Analysis of the laser-induced shock indicated about 60 to 70 percent energy absorption. Enhanced optical continuum emission from the interaction volume was attributed to plasma heating. GRA

N78-22910# Electric Power Research Inst., Palo Alto, Calif.
OVERVIEW OF STOPPERING OF OPEN MAGNETIC CONTAINMENT SYSTEMS FOR CONTROLLED FUSION
C. K. Hinrichs, A. J. Lichtenberg, and T. J. Dolan Jun. 1977 46 p refs
(EPRI-ER-394-SR) Avail: NTIS HC A03/MF A01

Magnetic confinement systems with the field lines leading out of the system are subject to end loss. The rate of end loss must be reduced to a sufficiently small value in a reactor such that fusion energy is generated more rapidly than energy is lost. The basic open ended systems either have too high an end loss to satisfy the reactor criterion (single mirrors and cusps), or are too long to be considered practical (long solenoids). Various end stopping schemes were proposed to reduce the end loss of open ended systems, and thus make the energy balance more favorable. The end stoppering techniques were electrostatic, RF, magnetic, material walls, and hybrid systems. The more important characteristics and the potentialities of the first three methods of end stoppering are summarized. ERA

N78-22911# Rochester Univ., N. Y. Dept. of Mechanical and Aerospace Sciences.
IMPROVED EIGENVALUE EQUATIONS FOR THE COLLISIONLESS DRIFT INSTABILITY IN TOKAMAKS
P. J. Catto and K. T. Tsang 1977 17 p refs Presented at the Ann. Am. Phys. Soc. Meeting, Atlanta, 7 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771136-4) Avail: NTIS HC A02/MF A01

Exact eigenvalue equations (for all even and odd spatial modes) that are valid for arbitrary growth rates were determined. Away from and perhaps near marginal stability, these more complete eigenvalue equations were required in order to accurately calculate growth rates. ERA

N78-22912# Princeton Univ., N. J.
TOKAMAK REACTORS
Robert G. Mills 1977 23 p refs Presented at the Winter Ann. Meeting of the Am. Soc. of Mech. Engr., Atlanta, 27 Nov. 1977
(Contract EY-76-C-02-3073)
(CONF-771120-5) Avail: NTIS HC A02/MF A01

The physical properties of nuclear fusion reactions govern the fuel choice and the selection of the operating plasma temperature. Engineering and economic feasibilities depend on achievable plasma densities at thermonuclear temperatures and on technological questions of achievable magnetic field, effects of radiation damage, and mechanical design problems. A pure fusion reactor has stringent requirements on its performance parameters. They may provide a more efficient method for burning the vast reserves of uranium 238. ERA

N78-22913# California Univ., Livermore. Lawrence Livermore Lab.
SYSTEM DESIGN FOR THE NEW TMX MACHINE
A. K. Chargin, M. O. Calderon, L. J. Mooney, and G. E. Vogtlin 19 Oct. 1977 6 p refs Presented at the 7th Symp. on Eng. Probl. of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-79749; Conf-771029-16) Avail: NTIS HC A02/MF A01

The tandem mirror experiment (TMX) is designed to test the physics of a new approach to Q-enhancement in open confinement systems. In the tandem mirror concept, the ends of a long solenoid are plugged electrostatically by means of ambipolar potential barriers created in two mirror machines or plugs, one at each end of the solenoid. The ambipolar potential in mirror machines develops as a consequence of the higher scattering rate of electrons and the balancing of electron and ion loss rates. The TMX experiment incorporates very few new engineering developments, but it does involve a new way of combining in an integrated system many previously developed ideas. The engineering task is to design the machine that would provide a proof-of-principle evaluation of the tandem mirror concept as rapidly as possible. ERA

N78-22914# Los Alamos Scientific Lab., N. Mex. Laser Research and Technology Div.
LASER FUSION PROGRAM Progress Report, 1 Oct. - 31 Dec. 1976
Eugene Stark, comp. and Frederick Skoberne, ed. Oct. 1977 122 p refs
(Contract W-7405-eng-36)
(LA-6834-PR) Avail: NTIS HC A06/MF A01

Progress in the development of high-energy short-pulse CO2 laser systems for fusion research is reported. The single beam system was used for target experimentation, and its optical train was improved. The initiation of two-beam target experiments on the two-beam system is described. Progress in construction checkout of the eight-beam system is continuing. The prototype program and HEGLF system design are discussed. Work in optical subsystem development, short-pulse amplifications, and saturable absorbers is described. Progress is reported in several areas of rare-gas oxide laser development and in the demonstration of damage-resistant reflectors. Heat-pipe metal vapor containment and work on dimeric mercury are described. Significant new support for wavelength-scaling in laser-target interactions is presented. The theory and predicted performance of vacuum insulation for preheat control is discussed. ERA

N78-22915# Oak Ridge National Lab., Tenn.
COMMERCIAL FEASIBILITY OF FUSION POWER BASED ON THE TOKAMAK CONCEPT
R. L. Reid and Don Steiner 1977 21 p refs Presented at ANS Winter Meeting, San Francisco, 27 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771109-55) Avail: NTIS HC A02/MF A01

The impact of plasma operating characteristics, engineering options, and technology on the capital cost trends of Tokamak power plants was determined. Tokamak power systems were compared to other advanced energy systems and found to be economically competitive. A three phase strategy for demonstrating commercial feasibility of fusion power, based on a common site multiple unit concept, is presented. ERA

N78-22916# Westinghouse Electric Corp., Pittsburgh, Pa.
SELECTION OF A CRYOSTABILIZED Nb3Sn CONDUCTOR FOR THE LARGE COIL PROGRAM
J. W. H. Chi, J. H. Murphy, and C. K. Jones 1977 27 p refs Presented at the 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract W-7405-eng-26)
(CONF-771029-91) Avail: NTIS HC A03/MF A01

The large Coil Project (LCP) is a program to design, fabricate and test relatively large superconducting toroidal field coils for Tokamak fusion reactor applications. Some basic requirements that affect the conductor design are cryostabilization, 8 tesla peak magnetic field, and a specified maximum refrigeration load. The engineering considerations that led to the selection of a forced flow supercritical helium cooled cable conductor are described. Comparisons of forced flow supercritical helium cooled cable conductors with pool boiling cooled monolithic conductors were made with regard to a number of factors such as the thermal capacity of the coolant, the thermal design margins, propensity for conductor normalization, predictability of the thermal flow performance, controllability of the cooling conditions, etc. It was concluded that, although there exists a number of design uncertainties and engineering problems, forced flow supercritical helium cooled conductors can provide a far more reliable coil design than the pool boiling monolithic concept. ERA

N78-22917# Oak Ridge National Lab., Tenn.
CONDUCTORS FOR TOKAMAK TOROIDAL FIELD COILS
William A. Fietz 1977 4 p refs Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract W-7405-eng-26)
(CONF-771029-142) Avail: NTIS HC A02/MF A01

Six conductors being developed for use in superconducting toroidal field coils of Tokamak fusion machines include three pool boiling and three forced flow concepts, all of which are described. Research and development programs on several of the conductors are under way, jointly involving Oak Ridge National Laboratory (ORNL) and conductor manufacturers. Conductors will be tested in short lengths and in the form of 3m x 2.5m large coil segment tests. The conductor development and testing is closely coordinated with the large coil program at ORNL. ERA

N78-22918# Oak Ridge National Lab., Tenn.
RADIATION EFFECTS ON INSULATORS FOR SUPERCONDUCTING MAGNETS
R. H. Kernohan, R. R. Coltman, Jr., and C. J. Long Jan. 1978 35 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6193) Avail: NTIS HC A03/MF A01

In order to determine the radiation stability of electrical insulation that could be used in a superconducting magnet for containment of the plasma in a fusion energy device, 55 specimens of eight types of organic insulation were irradiated to a dose of about 2 x 10 to the 8th power R (2 x 10 to the 6th power J/Kg) at a temperature of 4.8 K in the low-temperature irradiation facility in the bulk shielding reactor. Four of the specimens were monitored for changes in electrical resistivity during the irradiation. The initial resistivities, which were of the order of 10 to the 14th power omega cm, decreased to about 10 to the 13th power omega cm under the influence of a weak radiation field. At full power reactor operation (2 MW), the resistivities dropped to about 10 to the 11th power omega cm, but changed little during the irradiation. After the irradiation the resistivities increased, but not to the initial values, because of residual radioactivity near or in the experiment assembly. Restoration to near the initial resistivity values was later observed upon warming the specimens to room temperature and purging the irradiation chamber. The latter result may be related to outgassing induced by the irradiation. ERA

N78-22919# California Univ., Livermore. Lawrence Livermore Lab.
NEUTRON DIAGNOSTICS FOR LASER FUSION EXPERIMENTS
R. A. Lerche, L. W. Coleman, J. W. Houghton, and K. G. Tirsell Nov. 1977 30 p refs Presented at the Ann. Physical Soc. meeting, Atlanta, 7-11 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79795; Conf-771136-5) Avail: NTIS HC A03/MF A01

Three different neutron diagnostic instruments used to acquire data for judging the performance of D-T filled laser-fusion targets are described. Large scintillation detectors and a neutron activation

system are used to measure the number of 14-MeV reaction neutrons emitted from a target, and a 45-meter neutron time-of-flight spectrometer is used to determine the fuel ion temperature. The scintillation detectors are used for neutron yields above ten thousand per shot, and neutron activation by the Cu(n,2n)-63Cu-62 reaction is used as an additional diagnostic device for yields above one hundred million per shot. Application of these techniques to laser-fusion measurements data taken at the Argus laser facility, and neutron diagnostics being prepared for the Shiva facility are discussed. Comparison of experimental yield data obtained for a number of laser-fusion targets show that neutron yield values obtained by the neutron systems and alpha-particle yields by TOF methods are in good agreement.
ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N78-22920 Wisconsin Univ., Milwaukee.
BOMBARDING ELECTRON ENERGY EFFECTS IN ELECTRON STIMULATED DESORPTION STUDIES. ELECTRON ENERGIES: 50-6000 eV Ph.D. Thesis
Monte John Drinkwine 1977 235 p
Avail: Univ. Microfilms Order No. 78-04485

Electron Stimulated Desorption (ESD) of residual surface contaminants, such as hydrogen and fluorine, from possible controlled thermonuclear fusion reactor first wall materials (such as stainless steel and niobium) were investigated. Over the bombarding electron energy range 300 - 400 eV the energy distribution of ESD ions did not change perceptibly. The behavior of ESD cross section vs bombarding electron energy, over the range 50 - 6000 eV, was investigated. For all ESD ions, and all substrate materials, the same general behavior was observed. That is: the cross section increased to a maximum as the electron energy was increased; the maximum occurred, typically, in the electron energy range 200 - 500 eV; as the electron energy was increased further, the ESD cross section decreased slowly; for an electron energy of 4000 eV, the cross section was still approximately 1/3 of what it was at the maximum.
Dissert. Abstr.

N78-22921 Pennsylvania State Univ., University Park.
PHOTOCONDUCTIVITY AND PHOTOEMISSION STUDIES ON SINGLE CRYSTAL NICKEL OXIDE Ph.D. Thesis
Mohammed Yar Zaheer 1977 135 p
Avail: Univ. Microfilms Order No. 7803382

The total photoelectric yield measurements were performed on contaminated as well as atomically clean NiO surfaces and the effect of various contaminations on the photoelectric threshold was also investigated. The purity state of the surface was monitored by means of a quadrupole mass spectrometer within a conventional flash filament schedule. The photoelectric threshold for an atomically clean NiO surface was obtained as 5.33 + or - 0.02 ev. This fact indicates that the Fermi Level in NiO is located at, or near, the top of the uppermost narrow band level.
Dissert. Abstr.

N78-22922 California Inst. of Tech., Pasadena.
ANALYSIS OF DEFECT STRUCTURES IN HIGH PURITY COPPER SINGLE CRYSTALS USING X-RAY TOPOGRAPHIC TECHNIQUES Ph.D. Thesis
Gregory Prince Hamill 1978 84 p
Avail: Univ. Microfilms Order No. 78-03649

Copper single crystals were grown in a modified Czochralski system. The grown-in dislocations and those introduced through selective scratching of the polished (111) surfaces were observed using Berg-Barrett X-ray topography and Borrmann transmission topographic methods. Several aspects of the dislocation images may be understood on the basis of pure dynamical or kinematical theories of X-ray diffraction. Some observations, however, support the theory that both dynamical and kinematic effects must be considered to properly describe the experimental results. Stereo depth measurements of the dislocation images were taken under four sets of X-ray geometries. The minimum range of depths observed, approximately 1.0 to 2.0 mu m from the surface, was obtained for both methods of Berg-Barrett stereo topography.
Dissert. Abstr.

N78-22923 Illinois Univ., Urbana-Champaign.
IONIC MODEL FOR CHROMIUM, MANGANESE AND IRON IMPURITIES IN COPPER Ph.D. Thesis
Daniel Cornelius Abbas 1977 121 p
Avail: Univ. Microfilms Order No. 7803920

A model was developed which assumes a definite 3d(n) configuration with a definite L-S ground state and includes intraconfigurational energy level spittings due to a crystalline electric field and spin orbit coupling. The spin and orbital susceptibilities were calculated from the ionic structure and include the effects of the impurity electon-conduction electron mixing interaction in a perturbation treatment. Impurity hyperfine fields expected from the model was also calculated. Comparison of the model predictions with the data lead to the conclusion that: (1) Cr and Mn have the structure which corresponds to a monovalent configuration; (2) the crystal field at the site of the magnetic atoms was opposite of that usually assumed; and (3) the Weiss temperature of CuCr is higher that most previously reported values.
Dissert Abstr.

N78-22924 Illinois Univ., Urbana-Champaign.
EXPERIMENTAL INVESTIGATIONS OF THE PRETRANSITION BEHAVIOR NEAR THE NEMATIC-SMECTIC A PHASE TRANSITION Ph.D. Thesis
Kung-Chao Chu 1977 105 p
Avail: Univ. Microfilms Order No. 7803958

Two experiments are presented which measure the static and dynamic pretransition behavior of the nematic-smectic A phase transition of the liquid crystal CBOOA. The first experiment is a conventional Rayleigh light scattering measurement performed with excellent temperature control of the liquid crystal. The second is a novel magneto-optic experiment which uses an external magnetic field to distort the liquid crystal and a sensitive optical interference technique to measure the distortion. Both measurements are performed with millikelvin temperature resolution and yield critical exponents for the elastic constants and the twist viscosity coefficient. A theory of the nonlinear elastic response of liquid crystals near the nematic-smectic A phase transition is also presented.
Dissert Abstr.

N78-22925 Purdue Univ., Lafayette, Ind.
A PIEZOSPECTROSCOPIC STUDY OF THE RAMAN SPECTRA OF UNIAXIAL CRYSTALS Ph.D. Thesis
Ronald J. Briggs 1977 143 p
Avail: Univ. Microfilms Order No. 7803202

The first order Raman spectrum of alpha-quartz consisting of four totally symmetric A1 lines, four E lines with unresolved LO-TO split doublets, were investigated under uniaxial stress. All splittings and/or shifts were found to be linear in stress and hence describable in terms of a linear deformation theory. From measurements using three force directions the two deformation potential constants characterizing each A1 and the four constants characterizing each E line were deduced. The extreme sharpness of the 1/128 cm E line at liquid helium temperature allowed a Fabry-Perot interferometer to be used in the study of its behavior. The LO-TO splittings of the E lines at 1/263 cm, 1/695 cm, and 1/1160 cm were measured to be 1/1.25 cm plus or minus 1/0.09 cm, 1/2.39 cm plus or minus 1/0.10 cm, and -1/3.02 cm plus or minus 1/0.45 cm, respectively.
Dissert. Abstr.

N78-22926 Illinois Univ., Urbana-Champaign.
THERMALLY ACTIVATED DISLOCATION MOTION INCLUDING INERTIAL EFFECTS IN SOLID SOLUTIONS Ph.D. Thesis
Randall Duane Isaac 1977 220 p
Avail: Univ. Microfilms Order No. 784031

It was shown that a hysteresis loss which occurs for both segregated and nonsegregated obstacles also contributes to the bias stress effect. Bias stress data was obtained that indicate the significance of the hysteresis loss contribution to the bias stress effect. Internal friction measurements were obtained on pure Pb samples and on dilute Pb-Sn alloys. The dependence

on the damping coefficient was observed during the normal superconducting transition. From these data the distribution of the breakaway stress was obtained and the value of the damping parameter was determined. The value of the critical damping and the average dislocation loop length were also calculated for these samples. These results were combined to obtain the electronic damping coefficient. Dissert. Abstr.

N78-22927 California Univ., Davis.
THE ELECTRICAL CONDUCTIVITY OF IRON-SILICON ALLOYS AT HIGH PRESSURES AND THE EARTH'S CORE Ph.D. Thesis
George Matassov 1977 187 p
Avail: Univ. Microfilms Order No. 7803626

The P-V-T behavior and electrical conductivity of Fe-Si alloys was investigated by shock wave techniques. The measured Hugoniot data in the pressure range of 100 to 1500 kbars was used to calculate the equation of state of these alloys. Extrapolations of seismic velocity, density and pressure for X sub si = 0.25 fall within the narrow range of acceptable values for the outer core. The electrical conductivity of four Fe-Si alloys x sub si = 0.0777, 0.181, 0.25 and 0.342) was measured in the pressure range of 600 K to 2500 K. The electrical conductivities of the three highest Si concentrations showed only a small dependence upon the combined pressures and temperatures investigated. Dissert. Abstr.

N78-22928 Illinois Univ., Urbana-Champaign.
THEORY OF PHASE TRANSITIONS IN LIQUID CRYSTALS AND PLASTIC CRYSTALS Ph.D. Thesis
Robert Jay Meyer 1977 110 p
Avail: Univ. Microfilms Order No. 78-04085

The properties of the layered, or smectic, liquid crystals are explained in terms of progressive freezing-out of rotational and translational degrees of freedom within each smectic plane. McMillan's dipole-dipole interaction model is extended to include intermolecular repulsions. By considering both the intermolecular dipole-dipole and intermolecular phenyl or benzene group interactions the properties of the phases with two dimensional hexagonal lattices are discussed. The smectic H phase results from ordering of the dipoles. A smectic E phase is obtained with a herringbone structure resulting from ordering of the phenyl groups, and a smectic G phase resulting from order of both dipoles and phenyl groups. A Landau or continuum theory of the orientational phase transitions in crystalline methane is derived on the basis of molecular and lattice symmetry arguments. Dissert. Abstr.

N78-22929 Illinois Univ., Urbana-Champaign.
DETERMINATION OF THE LIQUID-GAS PHASE DIAGRAM FOR ELECTRONS AND HOLES IN GERMANIUM Ph.D. Thesis
William Joseph Miniscalco 1977 135 p
Avail: Univ. Microfilms Order No. 7804088

The electron-hole liquid-EHG-exciton system was investigated spectroscopically and particular attention paid to the liquid-gas critical region. Theoretical lineshapes for the electron-hole liquid (EHL) and excitons are derived and used to determine the liquid density. Measurements of the exciton line second moment and the ratio of the forbidden intensity to the allowed intensity are discussed and used to present convincing evidence that the broadening of the low energy edge of the exciton line near Tc is due to luminescence from the EHG. The lever rule for two coexisting phases is combined with the ratio of the EHG and EHL intensities to determine the EHG density. A universal liquid-gas coexistence curve is fitted to the results and the critical point is found to lie at T sub c=7.0 plus or minus 0.1 K, n sub c= 1/8.9 plus or minus 0.5 x 10 to the 16th power cubic cm. The position of the metal-insulator transition was estimated. Dissert. Abstr.

N78-22930 California Univ., Irvine.
RAMAN SPECTRA OF SILICON NITRIDE AND DOPED GALLIUM ARSENIDE Ph.D. Thesis
Ignatius Sunday Onyebuchi Muokebe 1977 204 p
Avail: Univ. Microfilms Order No. 78-03811

The lattice excitations in silicon nitride were investigated. The Argon-ion laser lines were used to perform Raman backscattering experiments on silicon nitride films. In the study of the Raman spectra of doped gallium arsenide several backscattering experiments were performed using Argon laser lines and He/Ne laser lines. The (111) surfaces and (110) cleaved surfaces were studied. Also studied were samples with lower carrier concentrations, mainly n-type (silicon doped) gallium arsenide. Dissert. Abstr.

N78-22931 Colorado State Univ., Fort Collins.
ELECTRONIC EFFECTS ON NUCLEAR SPIN-PHONON COUPLING IN Al, Cu, AND In Ph.D. Thesis
Edward Joseph Ozimek 1977 165 p
Avail: Univ. Microfilms Order No. 7802390

Several measurements were performed on a variety of single crystal metal systems. These measurements include (1) Hall field effects in aluminum, indium, thallium, and aluminum-zinc; (2) nuclear acoustic resonance studies of copper, aluminum-zinc, and aluminum; and (3) non-resonant attenuation and velocity dispersion measurements in indium. Theoretically, all of the above studies utilize common elements of the magnetoresistivity tensor. Dissert. Abstr.

N78-22932 California Inst. of Tech., Pasadena.
SOME THEORETICAL PROBLEMS IN LOW TEMPERATURE OPTICAL PROPERTIES OF SEMICONDUCTORS Ph.D. Thesis
Dee-Son Pan 1978 164 p
Avail: Univ. Microfilms Order No. 78-03652

This thesis contains five topics investigating some theoretical problems in the low temperature behavior of electrons and holes in semiconductors. The five topics are as follows: (1) phonon damping of the motion of the electron hole droplet in pure Ge; (2) impurity scattering in doped material and piezoelectric phonon scattering in pure polar material (droplets in doped material and polar material); (3) structure of an exiton bound to a neutral acceptor; (4) banding of the bound exitons in doped semiconductors; (5) the phenomenon of impact ionization of exitons in Ge and Si. Dissert. Abstr.

N78-22933 Wisconsin Univ., Madison.
AN ELECTRON DIFFRACTION STUDY OF THE STRUCTURE OF SILICON (100) Ph.D. Thesis
Thomas David Poppendieck 1977 227 p
Avail: Univ. Microfilms Order No. 7727752

A clean, well ordered, and reproducible surface was prepared by repeated heating to 1250 C, annealing at 900 C, and cooling at less that 1 C/second. This surface was reconstructed from the bulk structure and has a c(4 x 2) unit mesh. The diffracted intensity consists of the Bragg maxima expected from the bulk and secondary peaks whose properties suggest they were due to the diffraction from the resonstructed selvedge. The data were averaged at constant momentum transfer to extract the quasi-kinematic intensity. The magnitude and width of the secondary structure suggest the selvedge extends three to five atomic layers into the material. A model which gives a reasonable fit to the data has alternate rows of atoms in each of the outermost two planes removed, which exposes small facets of surface. Dissert. Abstr.

N78-22934 California Inst. of Tech., Pasadena.
INVESTIGATIONS OF THE CONDUCTOR-SEMICONDUCTOR INTERFACE Ph.D. Thesis
Robert Alan Scranton 1978 64 p
Avail: Univ. Microfilms Order No. 78-03655

Schottky barriers produced by polymeric sulfur nitride, (SN)x, on nine common III-V and II-VI compound semiconductors are compared to barriers formed by Au. The conductor (SN)x produces significantly higher barriers to n-type semiconductors and lower barriers to p-type semiconductors than Au, the most electronegative elemental metal. Details of (SN)x film deposition, samples preparation, and barrier height measurements are described. The rate of dissolution of amorphous Si into solid Al is measured. The rate of movement of the amorphous Si/Al interface is found to be much faster than predicted by a simple model of the transport of Si through Al. This result is related to defects in the growth of epitaxial Si using the solid phase epitaxy process. Dissert. Abstr.

N78-22935 Illinois Univ., Urbana-Champaign.
STUDY OF ELECTRON MOBILITY AND SCATTERING IN WEAK SURFACE INVERSION LAYER ON SILICON Ph.D. Thesis
Chyan-Chang Shiue 1977 89 p
Avail: Univ. Microfilms Order No. 7804156

A new experimental technique, using the equivalent circuit of semiconductor surface, has been used to study the electron mobility in the surface inversion layer near the conductance threshold. This method enables measurement of very low inversion electron concentration not possible previously. From the accurate electron concentration, the conductivity mobility near conduction threshold was computed. Conventional conductance measurements were performed to measure the conductivity mobility above threshold. The classical model using scattering by the random Coulomb potential was used to interpret the mobility drop. A new scattering model based on a high density of dipole potentials from process induced = Si-OH bonds near the interface of semiconductor was proposed. Dissert. Abstr.

N78-22936# California State Univ., San Diego. La Jolla Dept. of Physics.
SURFACE STRUCTURE OF ELECTRON-HOLE DROPS IN GERMANIUM AND SILICON Final Technical Report, 31 Oct. 1976 - 1 Nov. 1977
P. Vashishta and R. K. Kalia (Brown Univ.) Nov. 1977 62 p refs Prepared in cooperation with Brown Univ., Providence
(Contract N00014-76-C-0050; NR Proj. 017-653)
(AD-A050804; TR-45) Avail: NTIS HC A04/MF A01 CSCL 20/12

Density functional formalism of Hehenberg and Kohn (HK) was generalized for the case of a multicomponent plasma. Using the self-consistent Kohn-Sham (KS) equations for electrons and holes and local density approximation for exchange-correlation potential, one can investigate the surface characteristics of electron-hole liquid (EHL) in six configurations of Ge and Si was either Ge or Si, and Nu sub e and nu sub h were the number of occupied electron and hold bands, respectively.
Author (GRA)

N78-22937# Honeywell, Inc., Minneapolis, Minn. Defense Electronics Div.
EFFECTS OF ZrO2 SOURCE VARIATIONS ON PbZrO3-PbTiO3 PIEZOELECTRIC PROPERTIES
W. B. Harrison Dec. 1977 50 p
(Contract N00014-76-C-0623)
(AD-A051049; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/2

ZrO2, as derived from three zircon source minerals and many process variations, was physically and chemically analyzed. The impact of the ZrO2 variations obtained was then evaluated in both dry and wet blended lead zirconate-lead titanate, high drive type piezoelectric compositions. Proper purification and blending of the ZrO2 is shown to yield PZ-PT material with uniform low and high drive piezoelectric behavior. Single precipitated ZrO2 and dry blending are shown to be highly variable processes. Author (GRA)

N78-22938# RCA Labs., Princeton, N. J.
X-BAND SOLID-STATE MODULE FOR AIRBORNE ARRAY RADAR APPLICATIONS Semiannual Report, 1 Apr. - 30 Sep. 1977
R. L. Ernst and H. C. Huang Jan. 1978 79 p
(Contract N00173-76-C-0383)
(AD-A050545; PRRL-77-CR-49) Avail: NTIS HC A05/MF A01 CSCL 17/9

This report describes the progress during the second six-month period of an 18-month research program to develop amplifier modules suitable for airborne, active array radar applications. Using GaAs FETs as the active device, the design goal of these amplifier modules is an output power of 5 W with 25-db gain over the 9- to 10-GHz frequency band. Extensive characterization of the amplifiers during pulsed operation is also part of this program. It is projected that the amplifier module will be configured as a cascade of five balanced stages. To achieve high overall amplifier efficiency, the output power of the FETs will be tailored to each of the amplifier stages. In this report period, three new vapor-phase epitaxial reactors have been constructed under RCA support. Measurements show that excellent well-defined channel layers can be grown on buffer layers which are 1.0 micron or less in thickness using Reactor C. AuGe ohmic contact technology has been developed to the point of being compatible with the self-aligned gate process. The AuGe contacts have lower resistance, are truly ohmic compared to Ti/Pt/Au contacts, and should result in FETs with improved rf performance. GRA

N78-22939# Argonne National Lab., Ill.
RE-ENTRANT MAGNETISM IN RARE-EARTH SUPERCONDUCTING TERNARY COMPOUNDS
A. J. Freeman, T. Jarloborg, and T. J. Watson-Yang (Northwestern Univer.) 1977 10 p refs Presented at the Intern. Conf. on Magnetic Alloys and Oxides, Haifa, Israel, 15-18 Aug. 1977 Submitted for publication
(Contract W-31-109-eng-38)
(CONF-770820-2) Avail: NTIS HC A02/MF A01

Ab initio self-consistent linear muffin-tin orbital energy band calculations for the alloys M = Y, Er, and Ho are used to discuss the origin of superconductivity and magnetism in rare earth superconducting ternary compounds. The study follows a reported observation of reentrant magnetism accompanying the return to a normal state at low temperatures (T = 0.9K) in the superconductro ErRh4B4, which has a superconducting transition temperature of 8.5K. ERA

N78-22940# Oak Ridge National Lab., Tenn.
MECHANICAL BEHAVIOR AND STRESS EFFECTS IN HARD SUPERCONDUCTORS: A REVIEW
C. C. Koch and D. S. Easton Nov. 1977 72 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5857) Avail: NTIS HC A04/MF A01

The mechanical properties of type II superconducting materials are reviewed as well as the effect of stress on the superconducting properties of these materials. The bcc alloys niobium-titanium and niobium-zirconium exhibit good strength and extensive ductility at room temperature. Mechanical tests on these alloys at 4.2 K revealed serrated stress-strain curves, nonlinear elastic effects and reduced ductility. The nonlinear behavior is probably due to twinning and detwinning or a reversible stress-induced martensitic transformation. The brittle A-15 compound superconductors, such as Nb3Sn and V3Ga, exhibit unusual elastic properties and structural instabilities at cryogenic temperatures. The mechanical properties of alloy and compound composites, tapes, as well as composites of niobium carbonitride chemically vapor deposited on high strength carbon fibers are presented.
ERA

N78-22941# Cornell Univ., Ithaca, N. Y. Materials Science Center.
DIRECT OBSERVATION OF THE VACANCY STRUCTURE OF A (220) PLATELET IN AN ION-IRRADIATED PLATINUM-4.0 AT.% GOLD ALLOY
Ching-Yeu Wei and David N. Seidman Jun. 1977 30 p refs Sponsored in part by NSF
(Contract EY-76-S-02-3158)
(COO-3158-56; Rept-2830) Avail: NTIS HC A03/MF A01

A detailed field-ion microscope (FIM) study was made of the vacancy structure of a (220) platelet created by a single 30 keV W(+) ion in a platinum-4.0 at. percent gold alloy; the specimen was maintained at 40 K (below substage 2/sub B/) during the in situ irradiation. Prior to the pulsed field-evaporation dissection of the specimen at 40 K it was warmed isochronally to 100 K (above substage 2/sub c/). The (220) platelet was found to consist of 31 vacant lattice sites, lying in four (220) planes, and clustered in a disk-shaped region which is approximately 20 A in diameter. If only first nearest-neighbor lattice sites are considered then the distribution of cluster sizes is as follows: (1) two monovacancies; and (2) one jumbo vacancy cluster containing 29 vacancies. The range of the vacancy concentration within the (220) vacancy platelet is approximately 35 to 44 at. percent. Employing the modified Kinchin-Pease equation, it was calculated that the displacement efficiency (kappa) for this platelet is 0.12. ERA

N78-22942# Argonne National Lab., Ill.
THERMOELECTRIC EFFECT IN A NONEQUILIBRIUM SUPERCONDUCTOR

Charles M. Falco 1977 15 p refs Presented at Intern. Conf. on Thermoelec. Effects in Metallic Conductors, East Lansing, Mich., 10-12 Aug. 1977
(Contract W-31-109-eng-38)
(CONF-770859-1) Avail: NTIS HC A02/MF A01

Initial results are reported showing experimental evidence for a pair-quasiparticle electrochemical potential difference in a superconductor in a temperature gradient. This potential diverges at low temperature and, within the resolution of the data, seems to approach a constant value at T/sub c/. The data was used to extract a value for the thermal transport current of normal excitations in the superconductor. ERA

N78-22943# General Electric Co., Schenectady, N. Y. Power Generation and Propulsion Lab.
RESISTIVE CRYOGENIC CABLE, PHASE 3 Final Report
Oct. 1977 296 p refs
(Contracts EX-76-C-01-2104; E(49-18)-2104)
(EPRI-EL-503) Avail: NTIS HC A13/MF A01

This project was undertaken to design, fabricate and test components of an ac resistive cryogenic cable system. Fiber reinforced plastic was considered to be the most promising pipe material. Cellulose paper was selected for use as the dielectric in the cable samples tested. Around the liquid nitrogen containment pipe, a closed cell polyurethane foam thermal insulation was used as a more desirable envelope. A half-scale sample of pipe with adhesive joints passed all permeation and thermal/pressure cycling tests. Sections of cable were electrically tested for breakdown stress under step stress testing. Conductors were insulated with a wall of cellulose paper and impregnated with liquid nitrogen (LN2). The breakdown data from the 550-mil cables indicated a breakdown strength greater than 860 Volts/mil. Conventional volt-time dielectric aging studies show that LN2 impregnated cellulose paper exhibits excellent properties. A cable design study was performed in order to characterize the cost of fabricating, installing, and utilizing a resistive cryogenic system of 2000- to 5000/MVA capacity. It is concluded that more confidence is needed before embarking on a development effort for a full-scale system. ERA

N78-22944# Oak Ridge National Lab., Tenn.
INTERNATIONAL CONFERENCE ON DEFECTS IN INSULATING CRYSTALS
1977 524 p refs Conf. held at Gatlinburg, Tenn., 9-14 Oct. 1977; sponsored in part by NSF and ONR
(Contract W-7405-eng-26)
(CONF-771002) Avail: NTIS HC A22/MF A01

Summaries of conference papers are presented. Conference topics include transport properties, defect levels, superionic conductors, radiation effects, John-Teller effect, electron-lattice interactions, and relaxed excited states. ERA

N78-22945# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
STRUCTURE OF SOLID SURFACES AND OF ADSORBATES BY LOW-ENERGY ELECTRON DIFFRACTION
G. A. Somorjai 18 Oct. 1977 15 p refs Presented at the Intern. Conf. on Phys. of Transition Metals, Toronto, 15 Aug. 1977
(Contract W-7405-eng-48)
(LBL-6684; Conf-770827-9) Avail: NTIS HC A02/MF A01

Low energy electron diffraction theory has developed to the point where the diffraction beam intensities can be computed using the locations of the surface atoms as the only adjustable parameters. The position of atoms in many clean monatomic solid surfaces and the surface structures of ordered monolayers of adsorbed atoms have been determined this way. Surface crystallography studies are now extended to small hydrocarbon molecules that are adsorbed on metal surfaces. These studies are reviewed. ERA

N78-22946# Argonne National Lab., Ill.
SOUND PROPAGATION IN NORMAL AND SUPERFLUID He-3
J. B. Ketterson (Northwestern Univ.) and P. R. Roach 1977 8 p refs Presented at the IEEE Ann. Ultrasonics Symp., Phoenix, Ariz., 26-28 Oct. 1977
(Contract W-31-109-eng-38)
(CONF-771064-3) Avail: NTIS HC A02/MF A01

Liquid He-3 despite the rather simple nature of its interatomic force, displays striking properties at ultralow temperatures. Below about 0.002 K it behaves as a superfluid whose properties are related to, but are much more varied and complex than, those of superconducting electrons in metals. Ultrasonic waves prove to be a powerful probe of this system; here the acoustic properties of both the normal and superfluid phases of this liquid are reviewed. ERA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-22947 Maryland Univ., College Park.
CANONICAL FORMALISM AND THE ECSK THEORY Ph.D. Thesis
James Michael Nestor 1977 188 p
Avail: Univ. Microfilms Order No. 78-04501

The Einstein-Cartan-Sciama-Kibble (ECSK) theory was shown to be a gauge theory for the Poincare group. Then the torsion constraints were eliminated from the Lagrangian to establish a one to one correspondence between a source for the ECSK theory and a related source for the Einstein theory which will produce the same dynamics. This demonstrates that the two theories differ only in their prescription for passing from a particular source in Minkowski space to a source for geometrodynamical spacetime. The general form for the geometrodynamical Hamiltonian with general tensor source fields was derived without using any four dimensional Lagrangian. Special cases of this result were the ECSK and Einstein theories with general tensor sources. The Hamiltonian formulation of the ECSK theory was such that its initial value constraints were preserved and the initial value problem for the ECSK theory with generic tensor sources was well posed. Dissert. Abstr.

N78-22948 State Univ. of New York, Stony Brook.
THERMODYNAMIC PROPERTIES AND STRUCTURE OF A SYSTEM OF CHARGED HARD SPHERES Ph.D. Thesis
Kuo-Chen Wu 1978 176 p
Avail: Univ. Microfilms Order No. 7803160

The thermodynamic and structure of the system of charged particles at equilibrium were studied. As the simplest model that embodies the essential features of ionic solutions and fused salts, charged spheres were considered, mainly the binary mixture of the restricted primitive model (RPM) (charged spheres of equal daimeter under an over-all electrical-neutrality condition), but also considered were two limiting cases in which the diameter and charge of one species go to zero at the same time that the number density of that species goes to infinity, keeping the over-all charge neutrality. A heretofore undetected low density critical point was found for the charged hardsphere system. Dissert. Abstr.

N78-22949*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MONTE CARLO SOLUTION OF BOLTZMANN EQUATION FOR A SIMPLE MODEL OF HIGHLY NONEQUILIBRIUM DIATOMIC GASES: TRANSLATIONAL ROTATIONAL ENERGY RELAXATION
Kenneth K. Yoshikawa Apr. 1978 78 p refs
(NASA-TM-78481; A-7405) Avail: NTIS HC A05/MF A01 CSCL 07D

The semiclassical transition probability was incorporated in the simulation for energy exchange between rotational and translational energy. The results provide details on the fundamental mechanisms of gas kinetics where analytical methods were impractical. The validity of the local Maxwellian assumption and relaxation time, rotational-translational energy transition, and a

velocity analysis of the inelastic collision were discussed in detail. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-22950*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
[FLIGHT AND MISSION OPERATIONS SUPPORT FOR VOYAGER SPACECRAFT LAUNCHING AND VIKING-MARS MISSION]
Apr. 1978 39 p
(Contract NAS7-100)
(NASA-CR-156955; JPL-Pub-78-14) Avail: NTIS HC A03/MF A01 CSCL 05A

The activities of the Jet Propulsion Laboratory during fiscal year 1976-1977 are summarized. Areas covered include ongoing and planned flight projects, DSN operations and development, research and advanced development in science and engineering, and civil systems projects. In addition, administrative and operational facilities and developments are described. Author

N78-22951# Texas A&M Univ., College Station. Inst. of Statistics.
A NEW STATISTICAL APPROACH TO PROJECT SCHEDULING
R. L. Sielken, Jr. and H. O. Hartley Dec. 1977 50 p refs
(Contract N00014-68-A-0140; NR Proj. 047-700)
(AD-A050846; THEMIS-TR-56) Avail: NTIS HC A03/MF A01 CSCL 14/1

This paper describes a comprehensive new procedure for determining a minimum cost project schedule when the activities making up the project have durations which are random variables. The cost of an activity is assumed to be a convex piecewise linear function of the activity's mean duration. The objective is to determine the activity mean durations which both minimize the total project cost and insure that the mean of the corresponding project completion time distribution is less than or equal to a specified project deadline. The entire distribution of the project's completion time under the minimum cost schedule is a valuable by-product. GRA

N78-22952# National Bureau of Standards, Washington, D. C.
NATIONAL BUREAU OF STANDARDS JOURNAL OF RESEARCH, VOLUME 82, NUMBER 3, NOVEMBER - DECEMBER 1977 Bimonthly Report
Dec. 1977 105 p refs
(PB-276557/6; LC-62-37059) Avail: NTIS HC A06/MF A01 CSCL 07D

Contents of this document are as follows: (1) Phase equilibria and crystal chemistry of rubidium niobates and rubidium tantalates; (2) Investigation of calcium aluminate cement phases under high gaseous pressure; (3) Stimulated multiphoton bremsstrahlung in electron-ion collisions; (4) Transport coefficients in the one-fluid approximation; (5) Mathematical models of the transient heat flow to fuel droplets; (6) Enclavesless sets and MK-systems. GRA

N78-22953# National Bureau of Standards, Washington, D. C.
NATIONAL BUREAU OF STANDARDS JOURNAL OF RESEARCH, VOLUME 82, NUMBER 2, SEPTEMBER - OCTOBER 1977 Bimonthly Report
1977 59 p refs
(PB-276556/8; LC-62-37059) Avail: NTIS HC A04/MF A01 CSCL 07D

Contents include: (1) fundamentals of building heat transfer; (2) static pressure measurements of enclosure fires; (3) melting point, normal spectral emittance (at the melting point), and electrical resistivity (above 1900K) of titanium by a pulse heating method; (4) a method for the numerical evaluation of the second virial coefficient for polyatomic molecules; (5) minimum polynomials and control in linear systems eigenset generalizations of the eigenvalue concept. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N78-22954 North Carolina Univ., Chapel Hill.
A TREE ALGORITHM FOR NEAREST NEIGHBOR SEARCHING IN DOCUMENT RETRIEVAL SYSTEMS Ph.D. Thesis
Caroline Merriam Eastman 1977 117 p
Avail: Univ. Microfilms Order No. 7807126

The concept tree algorithm, a new associative retrieval algorithm suitable for document retrieval systems that use similarity measures to select documents, is described. The basic structure used is a binary tree; at each node a set of keys (concepts) is tested to select the most promising branch. Backtracking to initially rejected branches is allowed and often necessary. The concept tree algorithm was compared with two other searching algorithms, sequential search and clustered search. For large collections, the predicted average search time for a concept tree search is less than that for a sequential search and greater than that for a clustered search. Only the sequential search and the concept tree search quarantee that the near neighbors found are actually the nearest neighbors. Dissert. Abstr.

N78-22955# Committee on Information Hang-Ups, Washington, D.C. Working Group on Updating COSATI.
GUIDELINES FOR DESCRIPTIVE CATALOGING OF REPORTS: A REVISION OF COSATI STANDARD FOR DESCRIPTIVE CATALOGING OF GOVERNMENT SCIENTIFIC AND TECHNICAL REPORTS
Mar. 1978 72 p Revised
(AD-A050900; PB-277951; CIH-78/01) Avail: NTIS HC A04/MF A01 CSCL 05/2

The guidelines provide rules which can be used to produce practical uniformity of descriptive cataloging among those agencies, libraries and information centers who are exchanging bibliographic information in the report literature field, especially on magnetic tape or on-line. The principle changes in this edition, in addition to updating of examples, are: addition of a rule for state and local government agencies, inclusion of abbreviations for foreign as well as English words, use of two-letter abbreviations for state names, updating the names of foreign countries and adding their two-letter codes, adding information about patents and copyrighted material, updating and expanding the list of contract numbers and of permissible abbreviations in report numbers. Author (GRA)

N78-22956# National Bureau of Standards, Washington, D. C.
DIMENSIONS/NBS. VOLUME 62, NUMBER 1
Jan. 1978 37 p
(PB-276528/7; NBS/DIM-62-1) Avail: NTIS HC A03/MF A01 CSCL 05B

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by bureau management, and a listing of NBS publications. The table of contents for the current issue is: It's Never Too Late to Insulate; Perspectives on NBS: The Future of NBS--Jordan J. Baruch; Problems, Prospects, and the Search for a Proper Balance--Ernest Ambler; Warnings and Recommendations--Charles E. Peck; A current Assessment--William O. Baker; Progress Is Being Made in Solar Energy

Standards Development; CIPM Meeting Report; Vibrational Chemiluminescence Detected from Ion-Molecule Reactions; New Understanding of Molecular Structure; Standard Reference Material Issued for Purity of Drinking Water; Low Frequency Electrical Measurements; Ionizing Radiation Measurements; Selected Bibliography on Metric for Building Community; Hourly Solar Radiation Data for U.S. and Canada; NBS Publication Helps Put Windows to Work to Conserve Energy. GRA

N78-22957# Advisory Group for Aerospace Research and Development, Paris (France).
THE APPLICATION OF INEXPENSIVE MINICOMPUTERS TO INFORMATION WORK
Mar. 1978 88 p refs Presented at Lecture Series held at Delft (Netherlands), 17-18 Apr. 1978 and at Ankara, 20-21 Apr. 1978
(AGARD-LS-92; ISBN-92-835-1276-6) Avail: NTIS HC A05/MF A01

The ways in which many computers are used in information work are outlined including examples of their use in editing and publishing information bulletins, selective dissemination of information, and retrospective retrieval and library housekeeping. For individual titles, see N78-22958 through N78-22966.

N78-22958# National Defence Headquarters, Ottawa (Ontario). Scientific Information Services.
USE OF MINICOMPUTERS IN OSIS
R. A. McIvor *In* AGARD The Appl. of Inexpensive Minicomputers to Inform. Work Mar. 1978 5 p (For availability see N78-22957 13-82)
Avail: NTIS HC A05/MF A01

The reasons for the choice of a minicomputer system by the information service are discussed, and a general outline of the system is given. Particular attention is given to the data-input system and the advantages and disadvantages of various options are discussed. Experiences with a variety of input methods are described. Some expected future developments are indicated. Author

N78-22959# Minnesota Univ., Minneapolis. Wilson Library.
A SELECTION OF MINICOMPUTER SYSTEMS FOR BIBLIOGRAPHIC APPLICATIONS
Audrey N. Grosch *In* AGARD The Appl. of Inexpensive Minicomputers to Inform. Work Mar. 1978 8 p refs (For availability see N78-22957 13-82)
Avail: NTIS HC A05/MF A01

The selection of minicomputer systems for a wide range of potential bibliographic applications is considered from simple single dedicated library tasks such as circulation control through complex integrated library management or interactive retrieval systems. Basic assumptions and definition of a given system's capabilities, required functions, method of creation including design and development, and working environment are introduced. Minicomputer system development trends are highlighted to set in perspective a discussion of criteria for system selection. These criteria include the application and the determination of hardware, software, and general system factors having prime importance in system selection for bibliographic purposes. The minicomputer central processor, main memory, memory protection, peripheral devices, data communication interfaces, vendor supplied software, and instruction sets are discussed in light of bibliographic application. Other evaluative criteria such as vendor support, delivery and pricing schedules, and multiple vendor systems are briefly considered. Author

N78-22960# East Anglia Univ., Norwich (England). Library.
CIRCULATION CONTROL
Christopher J. Aslin *In* AGARD The Appl. of Inexpensive Minicomputers to Inform. Work Mar. 1978 11 p refs (For availability see N78-22957 13-82)
Avail: NTIS HC A05/MF A01

Examples of minicomputer circulation control systems are described to illustrate how the computer is utilized in different ways to cope with the problems of differing library requirements. Author

N78-22961# International Development Research Centre, Ottawa (Ontario).
THE IDRC'S MINICOMPUTER-BASED BIBLIOGRAPHIC INFORMATION SYSTEM
Faye A. Daneliuk *In* AGARD The Appl. of Inexpensive Minicomputers to Inform. Work Mar. 1978 9 p refs (For availability see N78-22957 13-82)
Avail: NTIS HC A05/MF A01

A minicomputer based information system developed to process bibliographic data, to provide many automatic procedures for managing library requirements, and to permit retrieval from several large data bases is described. The system is generalized to permit the creation of data bases of many different types, for example, data about projects, bibliographic data, and library accounting data. A fully interactive user language designed to enable the user to do anything from data entry to multiparameter retrieval or, for example, from generating a KWIC index to producing an accounting of outstanding book orders is discussed along with the file system, the text editor, and the sort/marge software. Author

N78-22962# Defence Research Information Centre, Orpington (England).
PRODUCTION OF AN ABSTRACTS JOURNAL
George W. Hart *In* AGARD The Appl. of Inexpensive Minicomputers to Inform. Work Mar. 1978 17 p refs (For availability see N78-22957 13-82)
Avail: NTIS HC A05/MF A01

Systems developed by information centers to produce an abstract journal with a minicomputer are described. Advantages the computer brings to the production of the abstract journal, including preparation of various types of indexes are emphasized. Other factors considered include form of input, processing procedures, and output equipment; contents and format of the journal; and source of software. J.M.S.

N78-22963# National Defence Headquarters, Ottawa (Ontario). Scientific Information Services.
SELECTIVE DISSEMINATION OF INFORMATION
R. A. McIvor *In* AGARD The Appl. of Inexpensive Minicomputers to Inform. Work Mar. 1978 3 p (For availability see N78-22957 13-82)
Avail: NTIS HC A05/MF A01

The preparation of search profiles and the role of the information scientist in their testing and maintenance are discussed in terms of a selective dissemination of information system (SDI). The methods of implementation of SDI programs, in particular the tradeoff between memory capacity and speed are included. A matching algorithm is described. Author

N78-22964# Lipman Management Resources Ltd., Maidenhead (England).
COST-EFFECTIVENESS IN LIBRARY AUTOMATION
J. H. Ashford *In* AGARD The Appl. of Inexpensive Minicomputers to Inform. Work Mar. 1978 6 p refs (For availability see N78-22957 13-82)
Avail: NTIS HC A05/MF A01

Development of minicomputer systems for library automation is discussed in terms of cost effectiveness. Factors characteristic of library needs are considered including: high volume and high complexity processes; the need to manage textual material where the meaning and use of the content are context dependent; and the requirement to install systems which are easy to use and robust for noncomputing users. Cost reduction and containment in the areas of circulation control, information retrieval, cataloguing, and management are examined. Collaboration among libraries in the development of library minicomputer systems and reuse of previously developed systems is proposed to reduce costs. J.M.S.

N78-22965# Minnesota Univ., Minneapolis. Wilson Library.
COMMERCIAL DATA BASE MANAGEMENT SYSTEM (DBMS) SOFTWARE IN LARGER MINICOMPUTER CONFIGURATIONS
Audrey N. Grosch *In* AGARD The Appl. of Inexpensive Minicomputers to Inform. Work Mar. 1978 10 p ref (For availability see N78-22957 13-82)
Avail: NTIS HC A05/MF A01

Data base management system (DBMS) software is compared to data management system (DMS) software and a brief historical

overview of development and use is presented as a background to a discussion of DBMS and the design of online systems for libraries. Some questions are posed to help a given library determine whether it should use a DBMS approach in its online system within a minicomputer or conventional computing environment. The data structures supported, the language facilities, the minimal hardware configurations, and various other component features of several minicomputers are discussed. Various systems are compared from the standpoint of potential of bibliographic systems use. Author

N78-22966# Informatics, Inc., Woodland Hills, Calif.
FUTURE PROSPECTS FOR MINICOMPUTERS
Frank V. Wagner *In* AGARD The Appl. of Inexpensive Minicomputers to Inform. Work Mar. 1978 9 p refs (For availability see N78-22957 13-82)
Avail: NTIS HC A05/MF A01

The development of decentralized computing and its impact on information systems are described. Emphasis is placed on increasing efficiency and reducing costs in the information processing industry. As an example, a simplified and inexpensive minicomputer system is described. It is proposed to replace Gorsch's Law with 'The Principle of Decentralized Computing'. Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-22967# Committee on Commerce, Science, and Transportation (U. S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1979
Washington GPO 1978 12 p H.R. 11401 referred to the Comm. on Commerce, Science, and Transportation, 95th Congr., 2d Sess., 26 Apr. 1978
Avail: US Capitol, Senate Document Room

The House resolution authorizing appropriations to NASA for research and development, construction of facilities, research and program management, and other purposes is presented. A.R.H.

N78-22968# Committee of the Whole House on the State of the Union (U. S. House).
ENERGY TRANSPORTATION SECURITY ACT OF 1977
Washington GPO 1977 87 p Report on H.R. 1037 together with additional views presented by the Comm. on Merchant Marine and Fisheries to the Comm. of the Whole House on the State of the Union, 95th Congr., 1st Sess., 26 Aug. 1977
(H-Rept-95-589; GPO-89-006) Avail: US Capitol, House Document Room

The legislative history of a bill requiring that a percentage of the United States oil imports be carried on U.S. flag commercial vessels is reviewed. Benefits of the bill are discussed as well as the cost of the legislation as determined by the General Accounting Office. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N78-22969*# National Aeronautics and Space Administration, Washington, D. C.
SPINOFF 1978 Annual Report
James J. Haggerty Jan. 1978 126 p Original contains color illustrations
(NASA-TM-79432) Avail: NTIS MF A01; SOD HC CSCL 05A

An annual report of NASA's Technology Utilization Program is presented. Major programs in space exploration, aeronautical research, and technology application were outlined, and the potential benefits of a direct nature are described. A sampling of indirect benefits resulting from the secondary use of aerospace technology in industry and the economy was also included. Nationwide activities of the technology utilization program in encouraging the broadest possible secondary use of technology emerging from aerospace programs were reported in detail. A list of regional NASA officials and others who can be contacted for technical information or assistance was also included. Author

N78-22970*# Ford Motor Co., Dearborn, Mich.
AUTOMOTIVE STIRLING ENGINE DEVELOPMENT PROGRAM Quarterly Technical Progress Report, Oct. 1977 - Dec. 1977
Ernest W. Kitzner Jan. 1978 98 p Sponsored in part by NASA
(Contract EC-77-C-02-4396)
(NASA-CR-135331; CONS/4396-1; QTPR-1) Avail: NTIS HC A05/MF A01 CSCL 13F

The Ford/DOE automotive Stirling engine development program is directed towards establishing the technological and developmental base that would enable a decision on whether an engineering program should be directed at Stirling engine production. The fuel economy assessment aims to achieve, with a high degree of confidence, the ERDA proposal estimate of 20.6 MPG (gasoline) for a 4500 lb 1WC Stirling engine passenger car. The current M-H fuel economy projection for the 170 HP Stirling engine is 15.7 MPG. The confidence level for this projection is 32%. A confidence level of 29% is projected for a 22.1 MPG estimate. If all of the planned analyses and test work is accomplished at the end of the one year effort, and the projected improvements are substantiated, the confidence levels would rise to 59% for the 20.6 MPG projection and 54% for the 22.1 MPG projection. Progress achieved thus far during the fuel economy assessment is discussed. Author

N78-22971*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF SPACE TECHNOLOGY TO THE STUDY OF THE USE OF NATURAL RESOURCES IN THE REPUBLIC OF PANAMA
Nidia Avila deNichols Mar. 1978 11 p refs Transl. into ENGLISH of conf. paper from the UN/FAO Regional Training Seminar (Bolivia), 1-9 Dec. 1977 p 1-7 Presented at the UN/FAO Regional Training Seminar on the Appl. of Satellite Remote Sensing, La Paz, Bolivia, 1-9 Dec. 1977 p 1-7 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75089) Avail: NTIS HC A02/MF A01 CSCL 08F

The status of satellite remote sensing techniques used in the Republic of Panama up to November, 1977 is reviewed. Author

N78-22972*# Teledyne Brown Engineering, Huntsville, Ala. Systems Div.
DATA SYSTEMS ELEMENTS TECHNOLOGY ASSESSMENT AND SYSTEM SPECIFICATIONS, ISSUE NO. 2
Apr. 1978 758 p refs

(Contract NAS8-32539)
(NASA-CR-150677; SD78-MSFC-2204) Avail: NTIS HC A99/MF A01 CSCL 05B

The ability to satisfy the objectives of future NASA Office of Applications programs is dependent on technology advances in a number of areas of data systems. The hardware and software technology of end-to-end systems (data processing elements through ground processing, dissemination, and presentation) are examined in terms of state of the art, trends, and projected developments in the 1980 to 1985 timeframe. Capability is considered in terms of elements that are either commercially available or that can be implemented from commercially available components with minimal development. Author

N78-22973# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.

TRANSPORTATION PLANNING: NETWORK MODELS AND THEIR IMPLEMENTATION

Thomas L. Magnanti and Bruce L. Golden Jan. 1978 59 p refs
(Contracts N00014-75-C-0556; DOT-TSC-1058; NR Proj. 347-027; MIT Proj. OSP-824911)
(AD-A050652; TR-143) Avail: NTIS HC A04/MF A01 CSCL 12/2

Transportation planning plays an essential role in shaping regional and urban lifestyle. Complex decisions regarding policy alternatives for railroads, shipping, airline, and roadway traffic can often be, and often have been, analyzed using network optimization techniques. In this paper, we survey applications of network algorithms to transportation planning, stressing networks models and their efficient computer implementation. We discuss recent contributions concerning shortest paths, minimum cost network flows, traffic equilibrium, vehicle routing, and network design and we enumerate several open research problems. Much of our discussion reflects an emerging theme in the analysis of transportation problems, the blending of ideas from transportation science, computer science, and operations research.
Author (GRA)

N78-22974# City of Wichita Falls, Tex.

SYSTEMS ANALYSIS STUDY OF SOLID WASTE COLLECTION MANAGEMENT. VOLUME 1: REPORTS ON NETWORK CODING, NETWORK SELECTION, AND INFORMATION SYSTEM TASKS

1977 128 p
(Grant EPA-S-800279)
(PB-276707/7; EPA-530/SW-150C-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 13B

A solid waste collection study was initiated in Wichita Falls, Texas, in October, 1972. Automation techniques were demonstrated in two major areas: (1) resource scheduling, measuring, and reporting for management control; and, (3) operational simulation for evaluation of management strategies and options. The management control area encompassed three substantial tasks. They were: (1) the development and demonstration of automated techniques for coding a solid waste collection network; (2) the development and demonstration of automated techniques for selecting efficient collection routes through a network and optimizing resource assignments to collection routes; and, (3) the development and implementation of an automated solid waste management information system. GRA

N78-22975# City of Wichita Falls, Tex. Dept. of Public Works.

SYSTEMS ANALYSIS STUDY OF SOLID WASTE COLLECTION MANAGEMENT. VOLUME 2: REPORTS ON SIMULATION TASKS

1977 234 p
(Grant EPA-S-800729)
(PB-276708/5; EPA-530/SW-150C-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 13B

The simulation and strategy evaluation area encompassed two substantial tasks. They were: (1) The development of a simulation model that will represent any of several solid waste collection environments: and, (2) The demonstration of the model as a tool for evaluating management strategies and for developing collection system optimization recommendations. GRA

N78-22976# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).

DISPOSAL OF HAZARDOUS WASTES: RECOMMENDED PROCEDURES FOR HAZARDOUS WASTE MANAGEMENT

Jun. 1977 102 p refs
(PB-276555/0; NATO/CCMS-62) Avail: NTIS HC A06/MF A01 CSCL 13B

This sub-project is focused on implementation topics or issues that arise from consideration of the options for an integrated hazardous waste management program by a country. These topics tend to group themselves around: (1) the identification of hazardous wastes; and (2) the authorization for operation of hazardous waste facilities. Although definitive conclusions in each subtopic were often not apparent, comparisons and contrasts between the concepts used by participating countries can provide useful insights for others interested in alternative approaches to these concepts. GRA

N78-22977# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).

DISPOSAL OF HAZARDOUS WASTES: ORGANIZATION

Jun. 1977 111 p
(PB-276559/2; NATO/CCMS-63) Avail: NTIS HC A06/MF A01 CSCL 13B

Contents include: hazardous waste management in the participating countries--(management principles and state of the art, regulations on waste stream control and practise of control, planning, limitation of disposal districts, waste exchange systems, liability, insurance, financing, and special regulations or management systems for special types of waste); (2) evaluation of results--(basic conditions of organizational measures, form of management of facilities, control, planning, waste exchange systems, liability, insurance, financing, and special regulation or management systems for special types of waste); (3) conclusions and recommendations. GRA

N78-22978# Michigan Univ., Ann Arbor.

NITRATE REMOVAL FROM WATER SUPPLIES BY ION EXCHANGE: EXECUTIVE SUMMARY 5 Final Report

Dennis A. Clifford and Walter J. Weber, Jr. Nov. 1977 52 p refs
(Grant EPA-R-803898)
(PB-277092/3; EPA-600/8-77-015) Avail: NTIS HC A04/MF A01 CSCL 13B

Two processes were examined in detail in this report--single-bed strong-base anion exchange with NaCl regeneration and two-bed strong-acid, weak-base ion exchange with HCl and NH4OH regeneration. Important design considerations were found to include the nitrate and sulfate concentrations in the raw water, the service flow rate, the resin bed depth, and the nitrate/chloride selectivity of the resin. The sulfate, nitrate, chloride, and bicarbonate selectivities and multicomponent column behavior of the anion resins available from U.S. manufacturers were examined. An important peripheral finding was that significant quantities of nonvolatile organics were leached from 'clean' resins into the treated water. GRA

N78-22979# CH2M/Hill, Bellevue, Wash.

MARKET ANALYSIS OF RECOVERED MATERIALS AND ENERGY FROM SOLID WASTE, EXECUTIVE SUMMARY

Jan. 1977 219 p Sponsored by Washington State Dept. of Ecology
(PB-277143/4; LC-77-624084) Avail: NTIS HC A10/MF A01 CSCL 13B

Existing and potential market conditions for material and energy recovered from solid wastes are described and the quantity and composition of residential and commercial wastes available for material and energy recovery from specific geographic waste shed areas in the State of Washington are presented. Major aspects of various resource recovery processes were listed and their suitability for specific waste sheds in the state were listed. The existing markets for material resources were identified and quantified, and the resource recovery potential of existing (1976) and (1980 and 1990) material and energy markets was evaluated. Author

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy, celestial mechanics; and astrometry.

N78-22980 Harvard Univ., Cambridge, Mass.
INFRARED OBSERVATIONS OF GALAXIES Ph.D. Thesis
Marc Aaronson 1977 242 p
Avail: Univ. Microfilms Order No. 78-03430

Multiaperture J (1.2 micron), H (1.6 micron), and K (2.2 micron) photometric observations are presented for the central regions of 91 galaxies distributed along the Hubble sequence, ranging in morphological type from early spiral to Magellanic irregular. In addition, multiaperture measurements of the luminosity-sensitive 2.3 micron CO absorption feature, and the temperature-sensitive 1.9 micron H2O absorption feature, are presented for about half the sample. The correlation of the data with parameters such as projected aperture size, absolute magnitude, and inclination angle is examined. The relation between U - V and V - K color is discussed and interpreted in terms of simple population and/or metallicity changes. Several non-stellar emission mechanisms are considered in regards to the small subset of galaxies found to have significant 2 micron excesses.
Dissert. Abstr.

N78-22981 California Inst. of Tech., Pasadena.
SMALL ANGLE SCATTERING OF RADIATION, PART 1. MOLECULAR EMISSION LINES AROUND EVOLVED STARS, PART 2 Ph.D. Thesis
Charles Roger Alcock 1978 133 p
Avail: Univ. Microfilms Order No. 78-03645

The effects of small angle scattering on a pulse of radiation, and an analysis of the particular case of X rays scattering off interstellar grains were studied, along with the excitation of SiO emission lines around evolved stars. Papers on the thermal emission lines and the maser emission lines were also included.
Dissert. Abstr.

N78-22982 Wisconsin Univ., Madison.
ANALYSES OF ULTRAVIOLET RESONANCE LINE PROFILES AND H ALPHA PROFILES FOR THE POSSIBLE EXISTENCE OF CORONAS IN O STARS Ph.D. Thesis
Gordon Lee Olson 1977 75 p
Avail: Univ. Microfilms Order No. 7727749

The thesis analyzes line profiles originating in the winds of O stars in two different spectral regions to test for the existence of high temperature regions in these winds. Therefore the first part of this work considers ultraviolet resonance lines and the second considers H alpha emission. The ultraviolet resonance lines of zeta Puppis are analyzed with a line fitting technique that determines the degree of ionization and radial dependence of the ionization in the stellar winds. Families of line profiles are calculated with the Sobolev approximation of line transfer and are presented with scaling laws to extend their applicability to any resonance line in any star. The second approach studied the H alpha line in zeta Orionis and zeta Pup. These lines are also analyzed by the Sobolev approximation for line transfer.
Dissert. Abstr.

N78-22983 Oregon Univ., Eugene.
OBSERVATION AND ANALYSIS OF LINEAR POLARIZATION IN SIX BINARY STAR SYSTEMS Ph.D. Thesis
Richard Jack Rudy 1977 99 p
Avail: Univ. Microfilms Order No. 78-02564

The six binaries that were observed were chosen for their accessibility during summers and fall; and for their high apparent brightness. In addition, they were all systems with indications of mass transfer, the principle cause of polarization found previously in binaries. In all six systems that were observed, variations were found to be synchronous with the orbital period of the system. The variation of the polarization with orbital phase was predominantly second harmonic in the orbital frequency. This suggested a simple Fourier analysis of the observational data. Determining the important second harmonic made possible an estimate of the inclination of the orbital plane, a parameter necessary in finding the mass of a binary system. Dissert. Abstr.

N78-22984*# Operations Research, Inc., Silver Spring, Md.
SUMMARY OF STUDIES FOR A SOLAR OPTICAL TELESCOPE IN SPACE: 1968-1976
J. Bremer and R. Kaul Oct. 1976 116 p refs
(Contract NAS5-23438)
(NASA-CR-156745) Avail: NTIS HC A06/MF A01 CSCL 20F

The primary objective of this review is to tabulate the basic recommendations of several solar telescope studies. A primary matrix, listing some of the basic optical parameters, was compiled and forms the basis for a table. From this table it is apparent that a strong consensus exists on the configuration of the telescope and on its fundamental dimensionless parameters. Other tables presented in this document address the basic approach of each study to the telescope design as well as to the design of critical subsystems. These subsystem problems include the material, coating, configuration, mounting, launch locks, and thermal control of the primary mirror, the structure of the main telescope and the instrument bay, the mechanisms for radiation rejection, thermal control, and meteoroid shielding, and methods of maintaining image quality by proper alignment and by image motion compensation.
Author

N78-22985# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
GEODETIC ASTRONOMY PROGRAM SYSTEM [PROGRAMMSYSTEM GEODAETISCHE ASTRONOMIE]
Alfred Bauch and Uwe Schroeder Bayerische Akad. der Wiss. 1977 80 p refs In GERMAN; ENGLISH summary
(Ser-B-223; TUM-Mitt-143; ISBN-3-7696-8526-1) Avail: NTIS HC A05/MF A01

Some ALGOL procedures and programs for computations in geodetic astronomy are presented. Three of these procedures are laid out for a convenient way to compute apparent places of stars, the others offer a convenient handling of the formulas of geodetic astronomy. An essential part of this program-system is a program for computing the observation ephemerides for different methods. In addition, an ALGOL program is presented for the computation of apparent places of stars at any hour angles from mean locations as well as some other ALGOL programs for the evaluation of different methods of observation in geodetic astronomy; they are supplemented with remarks for data input.
Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-22986 Maryland Univ., College Park.
NUMERICAL AND ANALYTIC SOLUTIONS OF THE BOLTZMANN EQUATION FOR COSMIC RAY TRANSPORT Ph.D. Thesis
John William Bieber 1977 230 p
Avail: Univ. Microfilms Order No. 78-04507

Eigenfunctions of the operator which describe the effects of adiabatic focusing and pitch angle scattering were defined and numerically evaluated. When the particle distribution function is expressed as a series of these focusing eigenfunctions, the Boltzmann equation is transformed into a matrix equation. A computer program used this matrix to calculate the distribution function as a function of time, and distance, and pitch angle determines the longitudinal transport of cosmic rays in a disordered, diverging magnetic field. The application of this theory of focused transport in the prediction of features of solar cosmic ray events and extragalactic radio sources is considered.

The effect of energy loss due to synchrotron radiation on electron propagation in a rectilinear magnetic field was also investigated. In a large area, a synchrotron radiation field can expand with superliminal velocity. Implications of this finding for radio galaxies and quasars are explored. Dissert. Abstr.

N78-22987 Illinois Univ., Urbana-Champaign.
DUST IN GLOBULAR STAR CLUSTERS Ph.D. Thesis
Sherman Paul Kanagy, II 1977 204 p
Avail: Univ. Microfilms Order No. 78-04041

Calibrated direct plates in four colors were taken of the globular clusters M, M13, and M15 using a 102 cm reflecting telescope. A total of five dark regions was studied by making microphotometer scans radially through the cluster centers at several position angles, using a small microphotometer aperture. A mean background continuum is estimated and compared with the cluster intensity profile in the region of each dark patch in order to estimate extinctions. Extinctions in the dark clouds are found to be a few tenths of a magnitude. Three hypotheses regarding the nature of the dark regions are considered. The dark regions are shown to arise from obscuration by intraglobular dust clouds of typical radii 0.1 - 0.3 and masses of about a thousandth of a solar mass. Dissert. Abstr.

N78-22988 Harvard Univ., Cambridge, Mass.
THE EVOLUTION OF CLUSTER X-RAY SOURCES Ph.D. Thesis
Stephen Charles Perrenod 1977 191 p
Avail: Univ. Microfilms Order No. 7803432

The evolutionary behavior over cosmological timescales of the intracluster medium in rich clusters of galaxies is calculated for the case of a time-dependent cluster gravitational potential. Both infall of primordial matter and ejection of metal-enriched galactic material are considered. The cluster X-ray properties as a function of redshift are predicted, and the results compared to observations of low-redshift clusters. The effects of evolution are strong; for example, cluster X-ray luminosities increase by about a factor of 10 from the epoch with redshift z = 1 until the present. The effects of evolution are shown to dominate in any cosmological test with X-ray clusters. Dissert. Abstr.

N78-22989 Missouri Univ., Columbia.
TRANSPORT PROCESSES IN DENSE STARS: ELECTRON DISTRIBUTION FUNCTIONS AND ELECTRON-ION SCATTERING INTEGRALS IN WHITE DWARF MATTER Ph.D. Thesis
Errol Sandler 1977 111 p
Avail: Univ. Microfilms Order No. 78-03768

The topic is investigated by considering approximate relaxation time solutions of the Boltzmann transport equation and quantum mechanically rigorous Coulomb scattering cross-sections which include pair correlation effects. Two representative white dwarf compositions are considered as environments within which these distribution functions and scattering integrals are investigated. First, a non-relativistic treatment is followed. At sufficiently high densities, it is found that the electron mean free path and relaxation times are considerably increased by relativistic effects, and that any subsequent calculations of the transport properties themselves should necessarily include such relativistic effects. Dissert. Abstr.

N78-22990 California Inst. of Tech., Pasadena.
MOLECULAR CLOUDS AND STAR FORMATION Ph.D. Thesis
Anneila Isabel Sargent 1977 130 p
Avail: Univ. Microfilms Order No. 7803654

Observations of the J = 1 yields 0 transition of C-13O were made in and around the region occupied by the young OB association Cepheus OB3 to determine the connection between newly formed stars and molecular clouds. Within the molecular cloud are found three regions in which different stages of star formation are identified. The membership and ages of the subgroups of the Cepheus OB3 association were re-examined, and their places of origin determined. There is currently little direct interaction between the stars and the molecular cloud, although a few younger subgroup stars still lie close to or within the complex. It appears that the younger and still-forming subgroups of Cepheus OB3 are created in a different way from the older subgroup. Dissert. Abstr.

N78-22991*# California Univ., Berkeley. Space Sciences Lab.
HELIUM GLOW DETECTOR EXPERIMENT, MA-088 Final Report
C. Stuart Bowyer 15 Jan. 1978 103 p refs
(Contract NAS9-13799)
(NASA-CR-151706; SSL-Ser-18-Issue-76) Avail: NTIS HC A06/MF A01 CSCL 03B

Of the two 584 A channels in the helium glow detector, channel #1 appeared to provide data with erratic count rates and undue susceptibility to dayglow and solar contamination possibly because of filter fatigue or failure. Channel #3 data appear normal and of high quality. For this reason only data from this last channel was analyzed and used for detailed comparison with theory. Reduction and fitting techniques are described, as well as applications of the data in the study of nighttime and daytime HeI 584 A emission. A hot model of the interstellar medium is presented. Topics covered in the appendix include: observations of interstellar helium with a gas absorption cell: implications for the structure of the local interstellar medium; EUV dayglow observations with a helium gas absorption cell; and EUV scattering from local interstellar helium at nonzero temperatures: implications for the derivations of interstellar medium parameters. A.R.H.

N78-22992# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.
SATELLITE OBSERVATIONS OF POLAR, MAGNETOTAIL LOBE, AND INTERPLANETARY ELECTRONS AT LOW ENERGIES Interim Report
Paul F. Mizera and Joseph F. Fennell 20 Jan. 1978 33 p refs
(Contract F04701-77-C-0078)
(AD-A050640; TR-0078(3690-05)-4; SAMSO-TR-78-6) Avail: NTIS HC A03/MF A01 CSCL 04/1

Low altitude satellite observations of the low energy electron fluxes that populate the polar regions are summarized and classified into two groups: (1) the very low intensity distributions and (2) the more intense, often structured distributions observed during magnetically disturbed conditions. High altitude observations of electron fluxes, including the solar wind and the tail lobes, are presented to suggest that class 1 observations are the result of direct access of interplanetary electrons through the lobes into the polar regions. Class 2 observations may be due in part to magnetospheric processes. Author (GRA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-22993# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
PLASMA NEAR VENUS FROM THE VENERA-9 AND 10 WIDE-ANGLE ANALYZER DATA
M. I. Verigin, K. I. Gringauz, T. Gombosi, T. K. Breus, V. V. Bezrukikh, A. P. Remizov, and G. I. Volkov 1977 36 p refs Presented at the IAGA Symp. on Solar Wind Interaction with Venus (SIV 3), Seattle, Aug. 1977
(D-251) Avail: NTIS HC A03/MF A01

Venera 9 and 10 satellite wide-angle plasma analyzer measurement results of both electron and ion plasma components near Venus are reported. Typical features of the near-Venus bow shock are shown. The electron and ion components in the plasma flow around zone and in the optical umbra of the planet are calculated. It is concluded that the plasma data analysis does not explain the origin of the magnetic field in the plasma-magnetic tail. ESA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-22994*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SOLAR ACTIVITY DURING SKYLAB: ITS DISTRIBUTION AND RELATION TO CORONAL HOLES

David M. Speich, Jesse B. Smith, Jr., Robert M. Wilson, and Patrick S. McIntosh (NOAA, Boulder, Colo.) Apr. 1978 35 p refs

(NASA-TM-78166) Avail: NTIS HC A03/MF A01 CSCL 03B

Solar active regions observed during the period of Skylab observations (May 1973-February 1974) were examined for properties that varied systematically with location on the sun, particularly with respect to the location of coronal holes. Approximately 90 percent of the optical and X-ray flare activity occurred in one solar hemisphere (136-315 heliographic degrees longitude). Active regions within 20 heliographic degrees of coronal holes were below average in lifetimes, flare production, and magnetic complexity. Histograms of solar flares as a function of solar longitude were aligned with H alpha synoptic charts on which active region serial numbers and coronal hole boundaries were added. Author

N78-22995*# Stanford Univ., Calif. Inst. for Plasma Research.

AN OBSERVATIONAL SEARCH FOR SOLAR PULSATIONS AT PERIODS FROM SEVEN TO SEVENTY MINUTES.

Phil H. Dittmer Aug. 1977 36 p refs Submitted for publication Sponsored in part by Max C. Fleischmann Found.

(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grants NSF ATM-74-19007; NSF DES-75-15664)

(NASA-CR-156296; AD-A047841; SU-IPR-708) Avail: NTIS HC A03/MF A01 CSCL 03/2

The large-scale solar velocity field has been measured by comparing Doppler shifts from the center and limb of the disk, using the non-magnetic line FeI 5123.730A. No statistically significant periodicities are observed at periods between seven and seventy minutes. This negative result agrees with other results obtained by observers using spectral techniques, and contrasts with the report of oscillations at similar periods by Hill and co-workers (Hill et al., 1976a; Brown et al., 1976). Hill's explanation of this apparent discrepancy is that his instrument has a greatly enhanced sensitivity to one of two possible modes of oscillation. Independent modeling of the sun's atmosphere confirms that the FFTD technique would have much greater sensitivity to one of the two modes. However, it is concluded that this mode cannot be present in sufficient quantity to explain the apparent discrepancy because of the structure of the sun's atmosphere and because of comparisons of velocity and temperature measurements at different levels of the atmosphere. In addition, questions are raised concerning the statistical significance of the peaks in the SCLERA power spectra. GRA

N78-22996*# Stanford Univ., Calif. Inst. for Plasma Research.

AN OBSERVATIONAL SEARCH FOR LARGE-SCALE ORGANIZATION OF FIVE-MINUTE OSCILLATIONS ON THE SUN

Phil H. Dittmer, Philip H. Scherrer, and John M. Wilcox Jul. 1977 22 p refs Submitted for publication Sponsored in part by Max C. Fleischmann Found.

(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grants NSF ATM-74-19007; NSF DES-75-15664)

(NASA-CR-156154; AD-A047842; SU-IPR-709) Avail: NTIS HC A02/MF A01 CSCL 03/2

The large-scale solar velocity field has been measured over an aperture of radius 0.8 R on 121 days between April and Sept., 1976. Measurements are made in the line FeI 5123.730A, employing a velocity subtraction technique similar to that of Severny et al. (1976). Comparisons of the amplitude and frequency of the five-minute resonant oscillations with the geomagnetic C9 index and magnetic sector boundaries show no evidence of any relationship between the oscillations and coronal holes or sector structure. The average period measured for the five-minute oscillation is 312.0 plus or minus 0.9 sec, which is longer than the average 296.1 plus or minus 1.3 sec period originally reported by Noyes and Leighton (1963) from measurements in the line CaI 6103. The average amplitude is 2.0 m/s, which agrees reasonably with the 2.4 m/s value reported by Fossat and Ricort (1975). This amplitude is larger than might have been expected from an extrapolation of the work of Tanenbaum et al. (1969) to a large aperture, and is evidence of a large horizontal wavelength for the oscillations. GRA

N78-22997*# Stanford Univ., Calif. Inst. for Plasma Research.

ON THE SUPPOSED ANTICORRELATION OF SOLAR POLAR AND EQUATORIAL ROTATION RATES

Thomas L. Duvall, Jr. and Leif Svalgaard May 1977 12 p refs Submitted for publication Sponsored in part by Max C. Fleischmann Found.

(Contract N00014-76-C-0207; Grants NSF ATM-74-19007; NSF DES-75-15664; NGR-05-020-559)

(NASA-CR-156155; AD-A047840; SU-IPR-702) Avail: NTIS HC A02/MF A01 CSCL 03/2

This report discusses a result that was thought to be caused by correlated variations of the sun's rotation at different latitudes is known to be the result of crosstalk between two of the parameters used to fit the differential rotation. GRA

N78-22998# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.

SIGNIFICANT SOLAR PROTON EVENTS, 1955-1969 Interim Report

M. A. Shea, D. F. Smart, A. H. Shapley, comp., and H. W. Kroehl, comp. 1 Feb. 1978 18 p refs Repr. from Solar-terrest. Phys. and Meteorol.: Working Doc. 2 p 119-134

(AD-A050642; AFGL-TR-78-0028) Avail: NTIS HC A02/MF A01 CSCL 04/1

A list of the significant solar proton events for the period 1955 through 1969 has been prepared with identification limited to events with solar proton induced absorption as measured by a riometer in the earth's polar caps. A total of 139 events were identified over this 15 year period. This table was compiled after a thorough search of primary data sources in order to ascertain an onset time, a time of maximum absorption, the value of the maximum absorption, and the duration of each event. The observing location is identified for each of the events. Author (GRA)

N78-22999# Academy of Sciences (USSR), Moscow. Inst. of Space Research.

THE INTERACTION OF THE SOLAR WIND ELECTRONS IN THE OPTICAL UMBRA OF VENUS WITH THE PLANETARY ATMOSPHERE: THE ORIGIN OF THE NIGHTTIME IONOSPHERE

K. I. Gringauz, M. I. Verigin, T. K. Breus, and T. Gombosi 1977 28 p refs Presented at the IAGA Symp. on Solar Wind Interaction with Venus (SIV 3), Seattle, Aug. 1977

(D-250) Avail: NTIS HC A03/MF A01

Basic results of radio occultation experiments of Venus satellites in the nighttime ionosphere are reported. Electron concentration profiles are calculated. The electron concentration in the nighttime ionosphere calculated from Venus umbra electron fluxes are compared to data of radio occultation measurements. ESA

N78-23000# Academy of Sciences (USSR), Moscow. Inst. of Space Research.

SOLAR WIND INTERACTION WITH MARTIAN MAGNETOSPHERE

O. L. Vaisberg, V. N. Smirnov, and A. N. Omeltchenko 1977 33 p refs

(D-252) Avail: NTIS HC A03/MF A01

Plasma and magnetic measurements on Mars 2, 3, and 5 satellites are reviewed. Similarity criterium was used for model comparison of the Martian magnetosphere with other planetary magnetospheres. The influence of external conditions on regions of interaction is considered. It is shown that at usual solar wind conditions, the magnetosphere is degenerated in such a way that the dimension of magnetic cavity and field strength allows interaction with the atmosphere of Mars. The earlier found

boundary layer is compared with plasmamantle (boundary layer) of terrestrial magnetosphere. Similarity and differences between the regions of solar wind interaction with Mars and Venus are considered. Author (ESA)

N78-23001# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ON THE NATURE OF SOLAR-WIND-VENUS INTERACTION
S. A. Romanov, V. N. Smirnov, and O. L. Vaisberg 1977 24 p refs
(D-253) Avail: NTIS HC A02/MF A01

Plasma measurements with a RIEP spectrometer onboard Venera 9 and 10 are discussed. Asymmetry of the Venusian bow shock was found and is apparently connected to the anisotropic nature of the solar wind. The shape and structure of the magnetoplasma tail are considered. Parameters of low energy plasma of the Venusian tail are given and sources of this plasma are analyzed. Author (ESA)

N78-23002# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 400, DECEMBER 1977. PART 2: COMPREHENSIVE REPORTS, DATA FOR JUNE - MAY 1977 AND MISCELLANEA
Helen E. Coffey Dec. 1977 76 p
(PB-277099/8; SGD-400-Pt-2; NOAA-78011613) Avail: NTIS HC A05/MF A01 CSCL 03B

Data are provided on: active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calender record, regional flare index, daily solar activity centers, solar radio waves, and cosmic rays. GRA

N78-23003# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR GEOPHYSICAL DATA NUMBER 400, DECEMBER 1977. PART 1: PROMPT REPORTS, DATA FOR NOVEMBER - OCTOBER 1977
Helen E. Coffey Dec. 1977 123 p
(PB-277098/0; SGD-400-Pt-1; NOAA-78011612) Avail: NTIS HC A06/MF A01 CSCL 03B

This report provides data for November 1977 on: alert period, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, inferred IP magnetic field polarities, mean solar magnetic field, and solar wind measurements. It also provides data for October 1977 data on: daily solar activity center, sudden ionospheric disturbances, solar radio waves, cosmic rays, geomagnetic indices and radio propagation indices. GRA

N78-23004# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 399, NOVEMBER 1977. PART 2: COMPREHENSIVE REPORTS, DATA FOR MAY - APRIL 1977 AND MISCELLANEA
Helen E. Coffey Nov. 1977 43 p
(PB-277097/2; SGD-399-Pt-2; NOAA-77121907) Avail: NTIS HC A03/MF A01 CSCL 03B

Data is provided on: active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calendar record, regional flare index, solar radio waves for August 1977 and solar X-ray radiation for September 1977. GRA

N78-23005# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 399, NOVEMBER 1977. PART 1: PROMPT REPORTS, DATA FOR OCTOBER - SEPTEMBER 1977
Helen E. Coffey Nov. 1977 134 p
(PB-277096/4; SGD-399-Pt-1; NOAA-77121906) Avail: NTIS HC A07/MF A01 CSCL 03B

Data is provided on: alert period, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, solar wind measurements, spacecraft observations, inferred IP magnetic field polarities, and mean solar magnetic field. It also provides data for September solar radio waves, cosmic rays, geomagnetic indices and radio propagation indices. GRA

N78-23006# High Altitude Observatory, Boulder, Colo.
PHOTOMETRY AND POLARIMETRY OF THE SOLAR CORONA OF 30 JUNE 1973
Carl Lilliequist Dec. 1977 90 p refs
(Grant NSF ATM-77-23757)
(PB-276709/3; NCAR/TN-128) Avail: NTIS HC A05/MF A01 CSCL 03B

The method of reduction, its strengths and weaknesses, and suggestions for improvements are discussed. A comparison of the coronal camera observations was made with other ground-based observations. Generally excellent agreement in white light photometry and polarimetry of the North Polar coronal region was most encouraging, while the discrepancies in other regions should provide insights into instrumental limitations or directions for future refinements. GRA

N78-22581# Israeli Program for Scientific Translations Ltd., Jerusalem.
TABLES OF SOLAR AND GEOPHYSICAL INDEXES
In its Effects of Solar Activity on the Earth's Atmosphere and Biosphere (TT-75-50015) 1977 p 270-290 Transl. into ENGLISH from the book "Vliyanie Solnechnoi Aktivnosti na Atmosferu i Biosferu Zemli" Moscow, Nauka Press, 1971 (For availability see N78-22561 13-51)
Copyright. Avail: NTIS HC A14/MF A01

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-23007 Arizona Univ., Tucson.
MEASUREMENT OF THE PRIMARY COSMIC RAY SPECTRUM FROM 5 TIMES 10 TO THE 11TH POWER eV TO 5 TIMES 10 TO THE 16TH POWER eV Ph.D. Thesis
Davis Howard Hartman, Jr. 1977 207 p
Avail: Univ. Microfilms

Three types of detectors, each covering a different energy range, were used during 212 hours of observation to measure atmospheric Cerenkov light pulses produced in extensive air showers. The measured pulse height spectrum was related to the primary cosmic ray spectrum by the use of Monte Carlo air shower simulation. Results indicate that the Cerenkov pulse spectrum can be fit to an inverse power function in the case of all three detector systems. The spectral index is different for the different detector systems, due to their different opening angles. The measured values were 2.49 plus or minus 0.003, 2.72 plus or minus 0.01, and 2.62 plus or minus 0.1 for the bare phototube, searchlight, and 10 meter reflector systems, respectively. Results were inclusive because of large fluctuations encountered and no definitive statement about the exact relation can be made. Dissert. Abstr.

N78-23008# Naval Research Lab., Washington, D. C.
THEORETICAL MODELS AND NUMERICAL ESTIMATES OF ACOUSTIC SIGNALS OF HIGH-ENERGY COSMIC PARTICLES IN THE OCEAN
Sam Hanish 15 Dec. 1977 83 p refs
(AD-A050563; AD-E000111; NRL-8150) Avail: NTIS HC A05/MF A01 CSCL 20/1

The generation of acoustic noise by deceleration of high-energy elementary particles in liquids has been documented in several publications by various groups of physicists, who have also provided tentative models for understanding and prediction. In this report several theoretical models are rederived, assembled, and compared, and further development is undertaken on a selected few. Numerical calculations are made in the specific cases of muons and neutrinos and conclusions are drawn as to the conditions under which the noise of cosmic particles in the ocean can be detected by hydrophones. Author (GRA)

N78-23009# Academy of Sciences (USSR), Moscow. Inst. of Space Research.

K-LINES IN SPECTRA OF X-RAY BINARIES
M. M. Basko 1977 42 p refs
(Grant NSF MPS-75-15837)
(PR-359) Avail: NTIS HC A03/MF A01

The reflection of X-rays in K-lines of heavy elements from the cold surface was calculated. The radiative transfer is treated rigorously, with the albedo in K-lines expressed in terms of the H-function for isotropic scattering. This approach was also applied to evaluate the spectral shape of the low-energy wing of the line formed by the once scattered K-photons. A detailed discussion is given of the main characteristics of K alpha-emission from the X-ray binaries. The prospects of observations of the narrow K alpha-lines in X-ray binaries were analyzed, with special attention paid to the new information that can be obtained from such observations. The minimum equivalent width which could be expected in the case of the iron K alpha-line was evaluated for a number of well-known X-ray binaries. Author (ESA)

N78-22653 Kiel Univ. (West Germany). Inst. fuer Reine und Angewandte Kernphysik.
THE COSMIC RAY SITUATION IN THE ORBIT OF SPACE-LAB
O. C. Allkofer *In* ESA Life-Sci. Res. in Space Sep. 1977 p 251-256 refs (For availability see N78-22619 13-51)
Avail: NTIS HC A16/MF A01

99 GENERAL

N78-23010*# National Aeronautics and Space Administration, Washington, D. C.
FOURTH NASA INTER-CENTER CONTROL SYSTEMS CONFERENCE
Jan. 1978 504 p refs Conf. held at Boston, 4-5 Nov. 1969
(NASA-CP-7) Avail: NTIS HC A22/MF A01 CSCL 12B

Space vehicle control applications are discussed, along with aircraft guidance, control, and handling qualities. System simulation and identification, engine control, advanced propulsion techniques, and advanced control techniques are also included. For individual titles, see N78-23011 through N78-23032.

N78-23011*# National Aeronautics and Space Administration. Manned Spacecraft Center, Cape Canaveral, Fla.
DESIGN DEVELOPMENT OF THE APOLLO LUNAR MODULE c18
Kenneth L. Cox *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 1-62 refs Presented at the Case Studies in System Control Workshop, Colorado Univ., 4 Aug. 1969; sponsored by the IEEE Group on Autom. Control (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 22B

The lunar module autopilot is a first generation digital control system design. The two torque sources available for the control function of the descent stage configuration consist of 16 reaction jets and a slow, gimbaled, throttlable engine. Design history, the design requirements, criteria, constraints, and general design philosophy of the control system development are reviewed. Comparative flight test results derived from design testing are presented. Author

N78-23012*# National Aeronautics and Space Administration. Manned Spacecraft Center, Cape Canaveral, Fla.
DESIGN DEVELOPMENT OF THE APOLLO COMMAND AND SERVICE MODULE THRUST VECTOR ATTITUDE CONTROL SYSTEMS c18
William H. Peters *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 63-82 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 22B

Development of the Apollo thrust vector control digital autopilot (TVC DAP) was summarized. This is the control system that provided pitch and yaw attitude control during velocity change maneuvers using the main rocket engine on the Apollo service module. A list of ten primary functional requirements for this control system are presented, each being subordinate to a more general requirement appearing earlier on the list. Development process functions were then identified and the essential information flow paths were explored. This provided some visibility into the particular NASA/contractor interface, as well as relationships between the many individual activities. Author

N78-23013*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBITING ASTRONOMICAL OBSERVATORY (OAO-A2) STABILIZATION AND CONTROL SUBSYSTEM c18
Thomas E. Huber *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 83-125 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 22B

The OAO was successfully operating for approximately 11 months and has made over 2500 stellar observations. The OAO control system was a complex system which takes the 4500-lb vehicle through initial stabilization to star tracker control where a pointing accuracy of less than 1 arc minute was achieved. To obtain this pointing accuracy, the system used six orthogonally mounted gimbaled star trackers. The trackers were two gimbaled devices, having a 1-deg field of view with a + or - 43 deg gimbal excursion. The tracker could recognize and track 2.0 magnitude stars or brighter. The flight results indicated spacecraft pointing accuracies of less than 1 arc minute after tracker calibration with spacecraft jitter less than 3 arc seconds. Author

N78-23014*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATIONS OF THE HYBRID COORDINATE METHOD TO THE TOPS AUTOPILOT c15
G. E. Fleischer *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 127-156 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 22B

Preliminary results are presented from the application of the hybrid coordinate method to modeling TOPS (thermoelectric outer planet spacecraft) structural dynamics. Computer simulated responses of the vehicle are included which illustrate the interaction of relatively flexible appendages with an autopilot control system. Comparisons were made between simplified single-axis models of the control loop, with spacecraft flexibility represented by hinged rigid bodies, and a very detailed three-axis spacecraft model whose flexible portions are described by modal coordinates. While single-axis system, root loci provided reasonable qualitative indications of stability margins in this case, they were quantitatively optimistic when matched against responses of the detailed model. Author

N78-23015*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STEERING LAWS FOR DOUBLE-GIMBAL CONTROL-MOMENT GYROS c15
Stephen W. Winder *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 157-173 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 22B

Derivation of CMG steering laws was considered. The type of CMG considered was a double gimbal one which has a constant magnitude momentum vector. The equations for the generation of torque of an inertially fixed CMG are presented. To realize a particular commanded torque, the gimbal rates of the CMG must be specified. These gimbal rates are shown to be functions of gimbal angle orientation and the commanded torque. The conventional cross-product steering law was derived by minimizing a function which was the square of the magnitude of the error between the commanded torque and the realizable torque of the gyro. This steering law was severely dependent upon the inner gimbal angle. When the inner gimbal reaches 90 degrees, the cross product law requires infinite outer gimbal rates to realize finite torque values. Author

N78-23016*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTIMUM HORIZONTAL GUIDANCE TECHNIQUES FOR AIRCRAFT c04
Heinz Erzberger and Homer Q. Lee *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 175-184 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 17G

Some problems of automatic guidance of an aircraft in the horizontal plane are described. The horizontal guidance tasks, which such a flight control system should be capable of performing, were identified as being of three types: guiding the aircraft from any initial location and initial heading to (1) any final location and heading; (2) intercept and fly along a line of specified direction; and (3) a final location with arbitrary final heading. Guidance problems such as capturing an ILS beam at a specified point on the beam, intercepting a VOR radial, and point-to-point navigation can be formulated in terms of these problems. The guidance laws minimize the arc distance to fly between initial and final conditions subject to constraints on the minimum turning radius. Author

N78-23017*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

INERTIALLY-AIDED, ALL-WEATHER LANDING SYSTEMS FOR C/TOL **c04**

Robert J. Pawlak *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 185-197 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 17G

Ways to improve significantly all-weather landing systems technology for conventional take-off and landing vehicles, primarily, the large commercial jets, were studied. It was concluded that there is a great deal to be gained by extensive use of inertial navigation system derived information, primarily, the translational information inherent in an inertial navigator, for improving all-weather landing system performance. Author

N78-23018*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN APPROACH TO THE DETERMINATION OF AIRCRAFT HANDLING QUALITIES USING PILOT TRANSFER FUNCTIONS **c08**

James J. Adams and Howard G. Hatch, Jr. *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 199-216 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 01C

It was shown that a correlation exists between pilot-aircraft system closed-loop characteristics, determined by using analytical expressions for pilot response along with the analytical expression for the aircraft response, and pilot ratings obtained in many previous flight and simulation studies. Two different levels of preferred pilot response were used. These levels were: (1) a static gain and a second-order lag function with a lag time constant of 0.2 second; and (2) a static gain, a lead time constant of 1 second, and a 0.2-second lag time constant. If a system response with a pitch-angle time constant of 2.6 seconds and a stable oscillatory mode of motion with a period of 2.5 seconds could be achieved with the first-level pilot model, it was shown that the pilot rating will be satisfactory for that vehicle. Author

N78-23019*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

A FREQUENCY DOMAIN APPROACH TO HANDLING QUALITIES DESIGN **c08**

William A. Wolovich *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 217-236 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 01C

A method for designing linear multivariable feedback control systems based on desired closed loop transfer matrix information is introduced. The technique which was employed to achieve the final design was based on a theoretical result, known as the structure theorem. The structure theorem was a frequency domain relationship which simplified the expression for the transfer matrix (matrix of transfer functions) of a linear time-invariant multivariable system. The effect of linear state variable feedback on the closed loop transfer matrix of the system was also clarified. Author

N78-23020*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

OPTIMAL REGULATOR OR CONVENTIONAL? SETUP TECHNIQUES FOR A MODEL FOLLOWING SIMULATOR CONTROL SYSTEM **c09**

Dwain A. Deets *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 237-252 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 14B

Optimal regulator technique was compared for determining simulator control system gains with the conventional servo analysis approach. Practical considerations, associated with airborne motion simulation using a model-following system, provided the basis for comparison. The simulation fidelity specifications selected were important in evaluating the relative advantages of the two methods. Frequency responses for a JetStar aircraft following a roll mode model were calculated digitally to illustrate the various cases. A technique for generating forward loop lead in the optimal regulator model-following problem was developed which increases the flexibility of that approach. It appeared to be the only way in which the optimal regulator method could meet the fidelity specifications. Author

N78-23021*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

QUASI-OPTIMAL CONTROL OF A MOVING-BASE SIMULATOR **c09**

Elwood C. Stewart *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 253-259 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 14B

The optimal control of a degree-of-freedom moving-base simulator is considered. The quasi-optimal control method due to Friedland was utilized. The problem, in broad terms, was to determine a control law for moving the simulator cab so that its motion would: (1) best approximate the desired aircraft response, and (2) not exceed the limited translational capability of the simulator. A variety of optimal responses were obtained by the method which emphasized different features of the response which were thought to be important in motion perception. Examples of such results are given, and the considerations important in initial subjective evaluations by experienced flight personnel are discussed. Author

N78-23022*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

SOME MODERN CONTROL TECHNIQUES FOR HUMAN OPERATOR MODELING AND IDENTIFICATION **c54**

Richard S. Shirley *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 261-298 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 05H

Some recent results in quantitative modeling of the human operator are reviewed as well as a method for processing his input-output data. Modern control techniques are applied to the pilot operating in a dynamic compensatory tracking task. Trained pilots are known to behave in an optimal manner under fully stressed conditions. This has led to the development of an optimal control model of the human operator which takes his limitations into account. A rationale for determining the appropriate cost functions is determined. Experimental results indicate that the model can closely predict pilot performance in one- or two-axis tracking tasks. The model predicts pilot remnant (noise), error scores, and frequency response in both single-axis and multi-axis tracking tasks. Author

N78-23023*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NORMAL SHOCK AND RESTART CONTROLS FOR A SUPERSONIC AIRBREATHING PROPULSION SYSTEM **c07**

George H. Neiner, Gary L. Cole, and Francis J. Paulovich *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 299-321 refs (For availability see N78-23010 13-99)

Avail: NTIS HC A22/MF A01 CSCL 21E

Results of experimental investigations to control a supersonic mixed-compression inlet coupled to a turbojet engine are presented. Special instrumentation and servoactuators were developed to have sufficiently fast dynamic response so that basic propulsion system dynamics were the main limitation to controllability. In some cases servoactuator input signals were

electronically limited to simulate moderate performance flight hardware. Author

N78-23024*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMAL CONTROL OF A SUPERSONIC INLET TO MINIMIZE FREQUENCY OF INLET UNSTART c07
Bruce Lehtinen, John R. Zeller, and Lucille C. Geyser *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 323-335 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 21E

A preliminary investigation into the use of modern control theory for the design of controls for a supersonic inlet is described. In particular, the task of controlling a mixed-compression supersonic inlet is formulated as a linear optimal stochastic control and estimation problem. An inlet can exhibit an undesirable instability due to excessive inlet normal shock motion. For the optimal control formulation of the inlet problem, a non quadratic performance index, which is equal to the expected frequency of inlet unstarts, is used. This physically meaningful performance index is minimized for a range of inlet disturbance and measurement noise covariances. Author

N78-23025*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONTROL SYSTEM STUDIES FOR THERMIONIC REACTORS c73
Richard J. Hermsen (Calif. State Polytech. Univ., Pomona) and Henrik G. Gronroos *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 337-364 refs (For availability see N78-23010 13-99)
(Contract NAS7-100)
Avail: NTIS HC A22/MF A01 CSCL 20C

In core thermionic reactor concepts are of interest for space missions that require electrical power in the range of a few tens of kilowatts up to several megawatts. The physical principle involved--thermionic direct conversion of heat to electricity at net efficiencies up to 15 percent--offers potential advantages when compared to other nuclear powerplant concepts. However, the integration of the thermionic diode electrode structure with high-temperature nuclear fuel materials presents new design problems and new reactor physical constraints. Among the topics that must be investigated are those associated with the control system. The results of analytical and simulation studies of thermionic reactor control performed at the Jet Propulsion Laboratory are discussed. Author

N78-23026*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF FLUIDICS TO NEW CONTROL COMPONENTS c34
Miles O. Dustin, Vernon D. Gebben, and Robert E. Wallhagen *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 365-386 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 20D

The inherent tolerance for nuclear radiation makes fluidic devices candidates for nuclear rocket control systems. Also, they are being considered for supersonic jet engine inlet control because of their high temperature and vibration tolerance. Three new control components being considered for these applications are described. A fluidic circuit to control a pneumatic stepping motor for nuclear rocket control drum actuation is discussed. An all-fluidic sensor being developed for determining the position of the normal shock in the inlet of a supersonic jet engine is outlined. A new vortex valve configuration is developed to prevent supersonic jet engine inlet unstarts by regulating bypass flow. Author

N78-23027*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MINIMUM ENERGY CONTROL OF A CLASS OF ELECTRICALLY DRIVEN VEHICLES c37
Yilmaz E. Sahinkaya *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 387-421 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 13F

Theoretical and experimental results are obtained in the investigation of a minimum energy control problem associated with a class of electrically driven vehicles. Analytical results are obtained by making several justifiable approximations in the dynamical equations of the plant, the performance index of which is related to the minimization of system energy consumption for any required control action. The control problem of interest is simplified and solved by using Bellman's invariant imbedding technique. The optimality of the resulting control law is compared with those of the bang-bang control law, which is the exact solution for the case of speed-setting control action, and the classical control laws under identical conditions. A stochastic optimization problem is then formulated and solved by using Bellman's dynamic programming technique. The resulting control law is mechanized for a particular vehicle configuration which is simulated in the laboratory. Author

N78-23028*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
A NEW FORMULATION FOR THE EPSILON METHOD APPLIED TO THE MINIMUM-TIME-TO-CLIMB PROBLEM c05
Lawrence W. Taylor, Jr. and Harriet J. Smith *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 423-434 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 01C

Balakrishnan's epsilon technique is used to compute minimum-time profiles for the F-104 airplane. This technique differs from the classical gradient method in that a quadratic penalty on the error in satisfying the equation of motion is included in the cost function to be minimized as a means of eliminating the requirement of satisfying the equations of motion. Although the number of unknown independent functions is increased to include the state variables, the evaluation of the gradient of the cost function is simplified, resulting in considerable computational savings, thereby making it appear feasible to use the epsilon method for real-time application. Author.

N78-23029*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETERMINATION OF OPTIMAL CONTROL USING IMBEDDING OF THE TERMINAL CONDITIONS c08
Raymond C. Montgomery *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 435-442 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 01C

The utility of a method to solve optimal control problems is discussed with emphasis placed on the solutions of singular optimal control problems. The method involves imbedding the optimization problem of interest in a family of optimization problems which are parameterized by their terminal conditions. The solution to the optimization problem is obtained by collapsing the terminal conditions of the family of problems onto those of the original problem, while appropriately modifying the control function to account for the changing terminal conditions. The utility of this method is illustrated by obtaining the solution to an aerial attack problem where the attacking vehicle must maneuver subject to control limitations so as to place the enemy in a certain relative position for launching a missile in the shortest possible time. Author

N78-23030*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STABILITY OF CONSTANT GAIN SYSTEMS WITH VECTOR FEEDBACK c63
George L. vonPragenau *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 443-471 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 12B

The state space, the controllability, and the observability concepts are discussed in connection with the proposed stability analysis which permits drastic dimensional reductions for a vector feedback problem. Any constant gain system's stability can thus be analyzed in the frequency domain with a single Nyquist plot. The analysis considers the total system with all loops closed, a disturbance vector as input, and the feedback vector as output. All constant gain systems are shown to be decomposable into stable subsystems where the degree of the decomposition determines the dimensions. The maximum decomposition results in the state-space approach which is the limit case. The method is demonstrated with the stability analysis of the pogo phenomenon, an oscillatory interaction between the propulsion and the

structure of a space vehicle. This problem, with eigenvalues over a hundred, was drastically but rigorously reduced to a stability analysis of a 4x4 matrix. Author

N78-23031*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYNTHESIS OF FINITE SETTLING TIME DISCRETE SYSTEMS **c66**
James A. Gatlin *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 473-494 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 12B

A new finite settling time (FST) control law is presented. The performance and the flexibility of this dual-rate, sampled-data law as applied to the class of error driven, feedback control systems are demonstrated. A hybrid analog/digital simulation is performed in order to illustrate the practical aspects of this type of finite settling time design. Author

N78-23032*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND PERFORMANCE OF HEART ASSIST OR ARTIFICIAL HEART CONTROL SYSTEMS **c52**
John A. Webb, Jr. and Vernon D. Gebben *In* NASA, Washington Fourth Inter-Center Control Systems Conf. Jan. 1978 p 495-506 refs (For availability see N78-23010 13-99)
Avail: NTIS HC A22/MF A01 CSCL 12B

The factors leading to the design of a controlled driving system for either a heart assist pump or artificial heart are discussed. The system provides square pressure waveform to drive a pneumatic-type blood pump. For assist usage the system uses an R-wave detector circuit that can detect the R-wave of the electrocardiogram in the presence of electrical disturbances. This circuit provides a signal useful for synchronizing an assist pump with the natural heart. It synchronizes a square wave circuit, the output of which is converted into square waveforms of pneumatic pressure suitable for driving both assist device and artificial heart. The pressure levels of the driving waveforms are controlled by means of feedback channels to maintain physiological regulation of the artificial heart's output flow. A more compact system that could achieve similar regulatory characteristics is also discussed. Author

N78-23033# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1977-4
Nov. 1977 96 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul-Aug. 1977 p 205-258 Original French report available from ONERA, Paris FF 30
(ESA-TT-428) Avail: NTIS HC A05/MF A01

The following topics are dealt with: theory for the core of highly rolled vortex sheets, the effect of Ti on two NiAl-type coatings of the IN 100 alloy, and X-ray spectroscopic analyzer for liquid alloys under a vacuum, measurement of nondiagonal generalized damping ratios during ground vibration tests, errors in the measurement of aircraft overflight noise due to its nonstationary character, and standardization of the Cactus accelerometer using results from an experimental program. For individual titles, see N78-23034 through N78-23039.

N78-23034# European Space Agency, Paris (France).
A THEORY ON THE CORE OF HIGHLY ROLLED-UP VORTEX SHEETS **c02**
Jean-Pierre Guiraud and Radyacour K. Zeytounian *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 1-16 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 205-212 Original report in FRENCH previously announced as A76-46364 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

A double scale technique allows the derivation of an asymptotic representation for the core of a highly rolled up vortex sheet. Starting from a rotational solution having the structure of a vortex filament it is shown how an expansion, based on the closeness of the turns of the sheet, may be used to generate a flow with a vortex sheet. The original continuous flow with distributed vorticity serves as a zero-th order approximation; by adding a discontinuous correction one gets a flow which is irrotational with concentrated vorticity. Two classical problems, the conical leading edge sheet of a delta wing and the trailing sheet of a wing, were investigated as far as their cores is concerned. Author (ESA)

N78-23035# European Space Agency, Paris (France).
COMPARATIVE STUDY OF TWO NiAl-TYPE COATINGS ON IN 100 ALLOY: EFFECTS OF TITANIUM **c26**
Bernard Dupre, Pierre Steinmetz, Bernard Roques, and Robert Pichoir *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 17-40 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 213-229 Original report in FRENCH previously announced as A77-50438 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

Two kinds of NiAl protective coatings for heat-resistant nickel-base alloys, one involving direct aluminization, the second involving pretreatment in nickel-chromium-yttrium powder followed by aluminization, were compared. The pretreatment and aluminization processes are described, and metallographic, microprobe, and electron microscope examinations of the resultant coated alloys are discussed. It was found that coatings obtained through direct aluminization, though suitable for alloys containing little titanium, are much less satisfactory for alloys with titanium contents of 3 to 5 %; however, the pretreatment process appears to promote precipitation of a layer of titanium carbonitride within the protective coating, resulting in lower titanium content for the beta-phase NiAl and reduced susceptibility to oxidation for the coating. Author (ESA)

N78-23036# European Space Agency, Paris (France).
LIQUID ALLOY ANALYZER IN VACUUM BY X EMISSION SPECTROGRAPHY **c25**
Bernard Daigne and Francois Girard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 41-52 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 231-237 Original report in FRENCH previously announced as A77-50439 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

An X-ray spectroscopy device for analyzing the selective evaporation of constituents of alloys produced in an electron-bombardment furnace is described. The device, which monitors X-ray radiation emitted by liquid alloys during the impact of electron beams used in the melting process, is an aid in assuring a well-defined composition for complex alloys. Problems associated with the application of the analyzer to the industrial-scale production of large ingots under a vacuum, including the protection of the X-ray detector from the heat flux and metallic vapors given off by the fused metal, and the development of measurement and data reduction schemes for efficient determination of the concentrations of various alloy constituents, are also considered. Author (ESA)

N78-23037# European Space Agency, Paris (France).
MEASUREMENT OF NON-DIAGONAL GENERALIZED DAMPING RATIOS DURING GROUND VIBRATION TESTS **c39**
Gabriel Coupry *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 53-65 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 239-244 Original report in FRENCH previously announced as A77-50440 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

Problems in measuring the nondiagonal damping ratios of a structure during ground vibration tests are discussed: in particular, a theoretical difficulty arising in the analysis of nondiagonal damping ratios due to dissipative coupling between the modes of the structure. Errors in the classical determination of vibratory effects through isolation of the excitations of the various modes were assessed; the use of generalized masses, deformations and damping ratios, instead of adapted values based on the concept of equiphase response, is suggested to eliminate the faulty analysis. A simple problem involving the nondiagonal damping ratios of a small twin-engined plane is also given. Author (ESA)

N78-23038# European Space Agency, Paris (France).
METROLOGY OF AIRCRAFT OVERFLIGHT NOISE. ERRORS DUE TO ITS NONSTATIONARY CHARACTER **c71**
Max Ernoult *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 66-86 refs Transl. into ENGLISH from La Rech Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 245-254 Original report in FRENCH previously announced as A77-50441 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

Techniques for measuring noise during aircraft overflights are described, with emphasis on the correction of errors due to the nonstationary nature of the received acoustic signals. Acoustic noise received by a fixed ground microphone is modeled as a Gaussian, nonstationary random process; the estimation bias, variance and mean square error are calculated for a stationary process modulated by an exponential. Optimal integration times for minimizing the mean square error are given. The results of the analysis, presented in graphical form, may be of use in interpreting spectral analyses of the acoustic noise and in choosing the most appropriate parameters for the analysis. Author (ESA)

N78-23039# European Space Agency, Paris (France).
IMPROVEMENT OF THE CHARACTERIZATION OF THE CACTUS ACCELEROMETER ON THE BASIS OF RESULTS OBTAINED DURING THE SCIENTIFIC OPERATIONAL PHASE **c14**
Jacques Beaussier and Anne-Marie Mainguy *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-4 (ESA-TT-428) Nov. 1977 p 87-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-4, Jul.-Aug. 1977 p 255-257 Original report in FRENCH previously announced as A77-50442 (For availability see N78-23033 13-99)
Avail: NTIS HC A05/MF A01

Data obtained during aeronomical studies that involved the Cactus accelerometer onboard the D5B Castor satellite were used to refine the standardization of the accelerometer. Experimental measurements of the acceleration effects recorded at the apogee of the satellite orbit are reported, and the relative importance of parasitic internal accelerations and of external effects due to terrestrial radiation is analyzed. It was found that the actual resolution of the Cactus accelerometer may be set at approximately 10 to the negative ninth power meters per sec.
Author (ESA)

N78-23040# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 580
21 Apr. 1978 72 p refs Transl. into ENGLISH from various Hungarian journals
(JPRS-70992) Avail: NTIS HC A04/MF A01

Topics covered include cosmonaut training, satellite power sources, the production and testing of microelectronics in Hungary, and parapsychology and psychotronics as seen by Polish scientists. For individual titles, see N78-23041 through N78-23044.

N78-23041# Joint Publications Research Service, Arlington, Va.
SOVIET-CZECH SPACE MISSION, COSMONAUT TRAINING DISCUSSED **c53**
Gy. L. *In its* Transl. on Eastern Europe (JPRS-70992) 21 Apr. 1978 p 1-4 Transl. into ENGLISH from Magy. Nemzet (Budapest), 11 Mar. 1978 p 3 (For availability see N78-23040 13-99)
Avail: NTIS HC A04/MF A01

Two astronauts from Hungary, Bulgaria, Cuba, Mongolia, and Romania were selected to join Polish and East German astronauts already undergoing a 12 to 18 month training program at the Gagarin training center in Star City. The initial phase of the program is devoted to the theory of space research and spaceflight. Studies include astronomy, ballistics, geology, agriculture, biology, and the operational characteristics of various spacecraft types. The second phase involves training for specific missions by using simulators of the Soyuz and Salyut spacecraft. Training facilities are described, and the trainees' daily schedule is included.

N78-23042# Joint Publications Research Service, Arlington, Va.
COMMENTARY ON POWDER SOURCES, INCLUDING NUCLEAR, FOR SATELLITES **c15**
Laszlo Jeki *In its* Transl. on Eastern Europe (JPRS-70992) 21 Apr. 1978 p 9-12 Transl. into ENGLISH from Magy. Hirlap (Budapest), 11 Feb. 1978 p 6 (For availability see N78-23040 13-99)
Avail: NTIS HC A04/MF A01

Solar energy collectors, power sources with radioisotopes, and nuclear reactors may all be used in the medium energy range to provide satellite power supplies. The disadvantages of solar energy collectors for various missions are described as well as the development of radioisotope power sources and their performance in U.S. satellites. For long service lives (more than one year), and for very high power requirements (in the megawatt range), the nuclear reactor is mandatory. The need for radiation shielding of instruments on satellites carrying such reactors is discussed as well as the radiation hazards related to uncontrolled reentry. The reactor used in Cosmos 954 is described. A.R.H.

N78-23043# Joint Publications Research Service, Arlington, Va.
ELECTRONIC PRODUCTS DEVELOPED AT COMMUNICATIONS RESEARCH INSTITUTE **c33**
In its Transl. on Eastern Europe (JPRS-70992) 21 Apr. 1978 p 13-17 Transl. into ENGLISH from Magy. Orszag (Budapest), no. 6, 5 Feb. 1978 p 20 (For availability see N78-23040 13-99)
Avail: NTIS HC A04/MF A01

The primary task of the Hungarian Research Institute of the Communications Technology Industry is the research and development of the designs and manufacturing technologies of solid state integrated circuits and the discrete components used in microelectronics. Major achievements in reliability testing methods and equipment are the development of: (1) mathematical-statistical methods of estimation; (2) short screening tests, of which the results can be used directly for product quality improvement; and systematic defect analyses and performance checks for product development of active and passive components. Specific tests are conducted upon request. A.R.H.

N78-23044# Joint Publications Research Service, Arlington, Va.
FAIRCHILD CONTRACT FOR MASS PRODUCTION OF INTEGRATED CIRCUITS **c33**
In its Transl. on Eastern Europe (JPRS-70992) 21 Apr. 1978 p 18-24 Transl. into ENGLISH from Hiradastech. (Budapest), no. 12, 1978 p 385-387 (For availability see N78-23040 13-99)
Avail: NTIS HC A04/MF A01

Relevant authorities in Hungary and the United States approved a contract between the National Planning Committee and the Fairchild Corp. for the mass production of integrated circuits. According to the provisions of the agreement, which have a duration of seven years, Fairchild will provide the manufacturing and measuring technology for plastic-capsulated bipolar digital and linear integrated circuits, will provide the manufacturing and testing facilities, and will make available all data and production techniques which are required for designing the plant, for manufacturing the products, and for proper services which are required for the operation of the plant. The technology to be implemented will be the same in all respects as that used in the Fairchild factories at the time the agreement is signed. Fairchild will supply most of the manufacturing and testing equipment. Author

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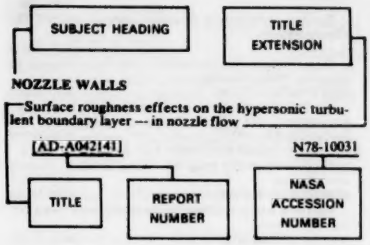

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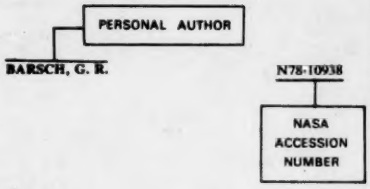

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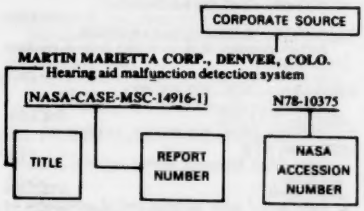

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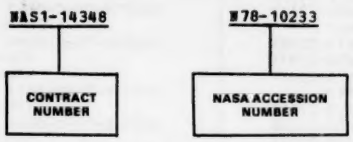

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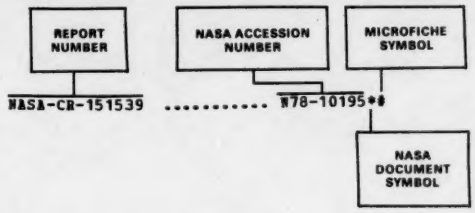

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